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STUDIES IN THE GENERA OF THE *DIOSMEAE* (RUTACEAE): 9. A REVISION OF THE GENUS *COLEONEMA*

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ABSTRACT

The eight species belonging to the genus *Coleonema* Bartl. & Wendl., including one new species, are described, with keys. The lectotypes of *Diosma rubra* L. and *Diosma ericoides* L. are chosen.

UITTREKSEL

STUDIES IN DIE GENERA VAN DIE *DIOSMEAE* (RUTACEAE): 9. 'N HERSIENING VAN DIE GENUS *COLEONEMA*

Die agt *Coleonema* Bartl. & Wendl. soorte, wat 'n nuwe soort insluit, word beskryf. Sleutels word gegee. Die lektotipes vir *Diosma rubra* L. en *Diosma ericoides* L. word aangewys.

AIM AND SCOPE OF THIS WORK

The last revision of the genus *Coleonema* by W. Sonder, was published in the *Flora Capensis* in 1860. In this work Sonder recognised only four species. Since then many more collections have been made and our knowledge of the species and of their distribution ranges has vastly expanded. It is now possible to obtain an overall picture of the genus and of the geographical distribution of the species. As it seems fairly unlikely that any new species of *Coleonema* remain to be discovered, this revision is now published as part of a continuing series of studies in the *Diosmeae*.

HISTORICAL BACKGROUND

Bartling & Wendland in their revision of the *Diosmeae* (1824) proposed the generic name *Coleonema*. At that time they were acquainted with only one species (*Diosma alba* Thunb.) which they transferred to *Coleonema*. They indicated that the name was made up from two Greek words meaning sheath and filament: *Nomen compositum e choleos, vagina, et nema, filamentum, qua filamenta in petalorum canaliculum ita immersa sunt, ut in vaginis occulta diceres.*

A. du Jussieu in his *Memoir* on the Rutaceae (1825) drew attention to the fact that he was acquainted with three species of *Coleonoema* but failed to publish any valid description or combination.

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Sprengel did not agree with Bartling and Wendland's creation of new genera in the *Diosmeae* and so in his *Systema Vegetabilium* (1825) he transferred them all back into *Diosma* resulting in a certain amount of confusion. For example Sprengel's *Diosma juniperina* was derived from *Acmadenia juniperina* and had nothing whatever to do with any species of *Coleonema* although Sonder thought it did when he proposed the name *Coleonema juniperinum* in his revision for the *Flora Capensis* (1860).

Von Schlechtendal in *Linnaea* (1831), working on Ecklon's collections, named two species of *Coleonema* merely regarding them as varieties of *C. album*.

In 1834, in *Curtis's Botanical Magazine*, an illustration of a beautiful pink flowered *Coleonema* appeared which had been in cultivation for some time in the Glasgow Botanic Garden. Named *Coleonema pulchrum* Hook. it has been, up to now, confused with three other pink flowered species of *Coleonema*.

Ecklon & Zeyher in their *Enumeratio Plantarum* (1835) mentioned six species of *Coleonema*, five of which were good species but for various reasons their name remains attached to only one.

Drège, who collected many species in the *Diosmeae*, collected very few Coleonemas, all of which were misidentified as *Diosma*.

As mentioned above the genus was revised by W. Sonder in the *Flora Capensis* (1860) and subsequently only one new species was described, that by Schlechter in 1899. Unfortunately he chose a name already published for another species thus making it illegitimate. The position was rectified by the substitution of the epithet *nubigenum* by Miss E. Esterhuysen in the *Journal of South African Botany* (1943).

MATERIAL AND METHODS

All descriptions, except for *C. virgatum*, have been done from fresh material collected by the author and populations have been studied in the field. Dissections have been done with the help of a Zeiss Stereomicroscope II and drawings made to scale without the aid of a drawing tube. Photographs giving a magnification of about × 10 were taken with a Pentax 35 mm camera through a photographic tube using the same microscope. Pollen was examined using a Reichert microscope with an oil immersion lens and measurements taken using a graticule in the eye piece. Drawings are two dimensional only and purely diagrammatic, petals for instance being shown as flattened out. Each species description terminates with a diagnosis stating how it differs from those it most resembles.

Coleonema Bartl. and Wendl. *Diosmeae* in Beitr. Bot. **1**: 55 (1824); A. Juss. in Mém. Mus. Hist. Nat., Paris **13**: 471 (1825); Don Gard. and Bot. **1**: 783 (1831); Curtis's bot. Mag. t.3340 (1834); Eckl. and Zeyh. Enum. Plant.: 106 (1835); Endl. Gen. Plant. **2**: 1157 (1840); Lindl. Veg. Kingd.: 471 (1853); Sond.

in Flor. Cap. **1**: 377 (1860); Benth. and Hook. Gen. Plant. **1**: 289 (1862–1867); Engl. Pflanzenfam. **19a**: 272 (1931); Dyer Gen. S. Afr. Flow. Pl. **1**: 290 (1975). Type species: *C. album* (Thunb.) Bartl. & Wendl. (*Diosma alba* Thunberg).

Diosma L. Sp. Pl. **1**: 198 (1753).

Adenandra Roem. & Sch. Syst. Veg. **5**: 451 (1819).

GENERIC DESCRIPTION

Shrubs 0,3–2,7 m tall, virgate, erect, arising except for *C. nubigenum*, from a single stem at base. *Branchlets* numerous, erect, fairly slender, glabrous, puberulous or thinly villous. *Leaves* 5–35 mm long, 0,7–1,5 mm broad, linear or linear-lanceolate, acute, mucronate, petiolate, alternate, glabrous, gland-dotted ± in two rows; margins narrowly translucent, smooth, ciliolate, serrulate or villous-ciliate. *Flowers* solitary, terminal or axillary, subtended by two bracteoles and 3–8 bracts (reduced leaves). *Petals* five, spreading, white or pink; *claw*, except for *C. nubigenum*, connate with the staminode. *Anthers* five, each with a minute apical gland. *Pollen* 33–47 μ long, 18–30 μ broad, ellipsoid, tri-porate. *Disc* obvallate, narrow, partly free, fairly level on top. *Stigma* 0,2–0,65 mm diam., capitate, depressed globose. *Style* and *filaments* short, glabrous. *Ovary* 5-carpellate, glabrous; apices globose with an immersed gland. *Fruit* 5-carpellate, glabrous, hornless or with horns short, spreading or erect.

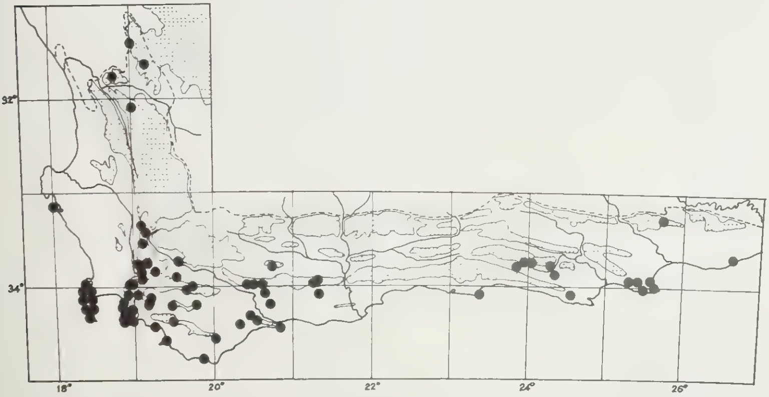

FIG. 1.
Distribution of the genus *Coleonema*. Dashed line shows boundary of the Cape Geological Series. Dotted areas show elevated ground.

DISTRIBUTION

Eight species of *Coleonema* are found in the south-western and southern Cape Province, extending from the Cape Peninsula northwards to Nieuwoudtville and eastwards to the mouth of the Bushmans River, all within an area defined by the Cape Geological Series, the northern boundary of which is indicated by a line of dashes on the distribution maps.

KEY TO THE SPECIES OF *COLEONEMA*

1 Staminode not connate with the petal .... **nubigenum 1.**
1^{+} Staminode partly connate with the petal 2
2 Flowers white,* petals up to 5 mm long 3
2^{+} Flowers usually pink, petals over 5 mm long 5
**Note:* Buds may sometimes be tinged with pink but flowers are white when open.
3 Flowers 3–4 mm diam., petals pappilose .... **juniperinum 2.**
3^{+} Flowers more than 5 mm diam., petals smooth 4
4 Leaves 13–19 mm long, 0,7–1 mm broad, flowers 5,5–6,5 mm diam. ...... **calycinum 3.**
4^{+} Leaves 12–13,5 mm long, 1,3–1,5 mm broad, flowers 6–7 mm diam. .... **album 4.**
5 Petals tapering evenly to the base .... **aspalathoides 5.**
5^{+} Petals with a narrow claw 6
6 Leaves 8–10 mm long, petals 5–5,7 mm long .... **pulchellum 6.**
6^{+} Leaves 15–35 mm long, petals 6,3–8,5 mm long 7
7 Petals 6,3–6,5 mm long, eglandular .... **virgatum 7.**
7^{+} Petals, 7,6–8,5 mm long, gland-dotted .... **pulchrum 8.**

1. **Coleonema nubigenum** Esterhuysen in Jl S. Afr. Bot. **9**: 137 (1943). Type: In regione austro-occidentali: In clivis montium prope French Hoek, alt. c. 3 000 ped., 18/11/1896, *Schlechter 9299* (BOL, lectotype; BM, G, GRA, PH, PRE, S, isotypes).

Coleonema gracile Schltr. in Bot. Jb. **27**: 163 (1899) nom. illegit. Non *C. gracile* Eckl. & Zeyh. Enum. Plant. **1**: 106 (1835).

Shrubs to 1 m tall, dense, rounded with many stems arising from a single rootstock, apparently able to coppice. *Branches* numerous, erect, glabrous, stout, tough, more or less clustered; bark dark brown, rough with circumferential leaf scars. *Branchlets* numerous, erect, slender, thinly deflexed, villous, green, clustered. *Leaves* 5–9 mm long (including the petiole 1–1,3 mm long), 1–1,3 mm broad, narrowly lanceolate, somewhat obtuse with a blunt callus at the apex, glabrous, recurved-erect, alternate; margins narrowly translucent, at first villous-ciliate becoming eciliate; abaxial surface rounded, gland-dotted to either side of the mid-rib and along both margins. *Inflorescence* solitary, terminal or axillary, subtended by two or three reduced leaves, one bract and two bracteoles; *flower* 7,5 mm diam. with petals white, soon delapsing. *Bract* 2 mm long, 0,6 mm broad, linear-lanceolate, narrowed above; apex with a red callus; margins densely crisped ciliate; adaxially densely crisped pubescent; abaxially glabrous and gland-dotted above, somewhat pubescent below. *Bracteoles* two, 1,5 mm long, 0,6 mm broad, lanceolate, obtuse; apex with a blunt callus; margins crisped ciliate, translucent below; adaxially somewhat pubescent; abaxially rounded, gland-dotted above, pubescent below. *Calyx lobes* five, 1,7 mm long, 1,1 mm broad, elliptic, glabrous, ciliate, translucent, apex minutely callused, gland-dotted on the midrib above. *Petals* five, 3,6–5 mm long overall, 1,9–2,9 mm broad, orbicular with the apex truncate or emarginate, white, glabrous, faintly veined, gland-dotted to either side of the midrib; *claw* about 2 mm long narrowing to the base. *Staminodes* five, 1–1,3 mm long, 0,3–0,4 mm broad, fusiform, narrowed below, apex gland tipped, glabrous. *Filaments* five, becoming 1 mm long, somewhat fusiform, glabrous. *Anthers* five, 0,7–1 mm long, 0,6 mm broad, yellow; apical gland globose, incurved, minutely stipitate. *Pollen* 38–40 μ long, 18–20 μ broad, ellipsoid. *Disc* obvallate, slender, exceeded by the ovary, hidden from above by the swollen filaments and staminodes. *Stigma* 0,2 mm diam., capitellate. *Style* glabrous, slender, deflexed at first, becoming erect, 1 mm long. *Ovary* 5-carpellate, 0,7 mm diam., glabrous, lumpy with oil glands. *Fruit* 5-carpellate, 5 mm long, 5 mm diam., glabrous, gland-dotted, green, purplish above, deeply divided, hornless, apices emarginate. *Seed* 3,5–4,1 mm long, 1,7 mm broad, black, shining; aril black.

This species from the mountains of the South Western Cape Province was apparently first collected by Oldenburg when at the Cape in 1772. It remained virtually unnoticed however until collected by Schlechter in 1896. Unfortunately, in describing the plant, he chose the epithet *gracile* a name which had already been used by Ecklon & Zeyher for another quite different species in the same genus. Miss E. Esterhuysen of the Bolus Herbarium therefore renamed the species *Coleonema nubigena*. Schlechter distributed duplicates to many herbaria. But as was usual he did not nominate the holotype and so, in view of this, Schlechter's specimen at the Bolus Herbarium has been chosen as the lectotype. The epithet *nubigena* is perhaps more correctly spelt *nubigenum* in order to agree in gender with the generic name which is neuter.

SPECIMENS EXAMINED

CAPE—3318 (Cape Town): Jonkershoek, Stellenbosch Division (-DD), 17/11/1935, *Berg s.n.* (BOL); Jonkershoek valley, rocky slopes, W. aspect, along path below cliffs, Stellenbosch Division, 2 500–3 000 ft., 12/11/1961, *Esterhuysen 29294* (BOL); Banhoek Valley, slopes of Drakenstein Mountains, Stellenbosch Division, –/12/1939, *Esterhuysen 1469* (BOL, PRE).
—3319 (Worcester): French Hoek, Paarl Division (-CC), 3 300 ft., 19/11/1896, *Schlechter 9299* (BM, BOL, G, GRA, PH, PRE, S), 3 600 ft., 20/12/1895, *H. Bolus s.n.* (NBG); French Hoek Forest Reserve, Paarl Division, 28/9/1935, *Compton 5781* (NBG); Haalhoek Sneeuwkop, S.E. slopes, Paarl Division, 3 000 ft., –/12/1938, *Esterhuysen 1224* (BOL); S. slopes of Tierkloof, Wemmershoek, Paarl Division, 3 000–4 000 ft., 5/11/1950, *Esterhuysen 17729* (BOL, PRE); Wemmershoek valley, Paarl Division, –/12/1944, *Stokoe s.n.* (SAM); Du Toits Peak, frontal ridge, Worcester Division, 28/2/1960, *Esterhuysen 28451* (BOL).
—3418 (Simonstown): Somersetsneeuwkop, slopes above Diepgat, Caledon

Division (-BB), 4 000 ft., 13/12/1942, *Esterhuysen 8246* (BOL); Somersetsneeuwkop, on S.E. slopes, Caledon Division, 4 000 ft., –/12/1939, *Esterhuysen 4268* (BOL, NBG, PRE); Somersetsneeuwkop, Caledon Division, 3 750 ft., –/2/1943, *Stokoe s.n.* (SAM); Somersetsneeuwkop/Landdrostkop, Caledon Division, 26/9/1943, *Stokoe 9278* (NBG, *8862* at PRE); above zigzag on path to Somersetsneeuwkop, Caledon Division, 18/12/1971, *Vogelpoel W. 1610* (NBG, PRE); on zigzag path to Somersetsneeuwkop, Caledon Division, 4 350 ft., 28/12/1975, *Williams 2168* (NBG); Landdrostkop, Caledon Division, 3 000 ft., –/12/1940, *Stokoe 7669* (NBG, PRE, SAM); Landdrostkop, N. side near path, 3 900 ft., 28/12/1975, *Williams 2166* (NBG).

—3419 (Caledon): Victoria Peak, S. slopes, Caledon Division (-AA), 4 000 ft., 2/1/1944, *Esterhuysen 9755* (BOL, PRE); between Viljoens Pass and Somersetsneeuwkop, Caledon Division, –/10/1938, *Stokoe 6523* (BOL); Nuweberg Forest Reserve near end of road to hut, Caledon Division, 3 400 ft., 28/12/1975, *Williams 2173* (NBG); S.E. slopes of Rooskraalberg, Caledon Division, 3 000 ft., –/7/1940, *Esterhuysen 2645* (BOL); Dwarsberg, Jonkershoek, Stellenbosch Division, 9/2/1959, *Rycroft 2141* (NBG); W. edge of Dwarsberg, Jonkershoek, zigzag beyond 2nd waterfall, Stellenbosch Division, 3 200 ft., 30/1/1963, *Taylor 4619* (PRE, STE), 4 000 ft., 13/3/1967, *Kruger 407* (PRE), 3 800 ft., 12/11/1965, *Taylor 6586* (PRE).

Without locality: –/–/1772, *Oldenburg 1281* (BM), *Niven s.n.* (BM).

Distribution and Biology

Coleonema nubigenum is endemic to the Hottentots Holland, French Hoek and Du Toits Kloof Mountains. This is a fairly narrow area less than 40 km in length from north to south, enjoying what is probably the highest rainfall in the country. The plants are found at altitudes of between 900 and 1 400 m above sea level. Flowering has been observed to begin in September, with plants in full bloom from November to February. Specimens with ripe fruits have been collected from December to March. The plants are tough with many stems and appear to coppice from the stump. The small white flowers stand wide open with the narrow disc hidden beneath fusiform staminodes and filaments. Although the presence of nectar has not been observed, the pollen does not appear to be dispersed by wind so one may conclude that the flowers are pollinated by insects. Seed when ripe is dispersed by the usual catapult mechanism. The leaves when crushed have a pleasant smell rather like coconut.

Neither variation nor hybridisation have been observed.

Discussion

Of this plant, in the genus *Coleonema,* Schlechter remarked "The above plants can be recognised from all other species in the genus by their staminodes

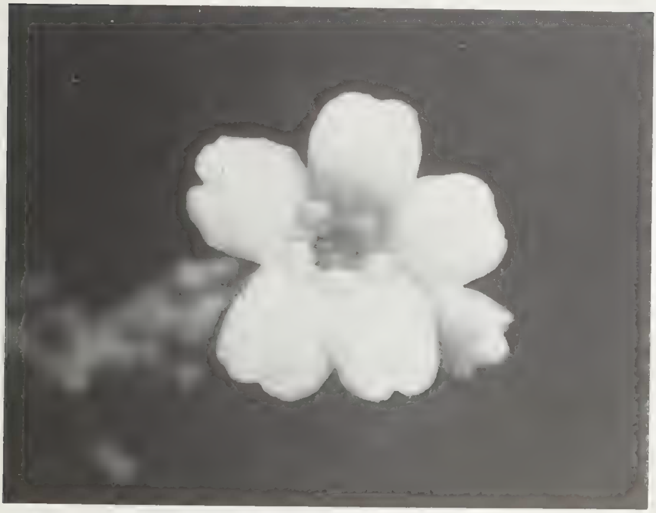

FIG. 2.
Coleonema nubigenum: flower, 7,5 mm diam.

which are quite free of the petals and by the blunt, mostly visibly separated and distinct petals. In appearance they are mostly like *C. juniperinum* Sond., . . ." In support of Schlechter's decision to place this species in *Coleonema*, in spite of its not possessing the one character most typical of the genus, viz. that of having the staminodes connate with the petal, one takes into account the following characters that are typical of other plants in the genus: the numerous branchlets; the narrow, alternate leaves; the occasionally axillary and solitary flowers; the numerous modified leaves at the base of the flower; the very open throat of the flower (compare with *C. calycinum* in Fig. 6); the staminode although not lying in a groove in or connate with the petal, actually arises close to the base of the petal, its fusiform shape compares well with that of the staminode in *C. juniperinum* (Fig. 5 No. 6); the narrow obvallate disc is typical of that in all species of *Coleonema* and is also exceeded by the ovary in both *C. album* and *C. juniperinum*; the 5-carpellate fruit; the sweet smell of the leaves when crushed.

Coleonema nubigenum is a very distinct species. It differs from all others in the genus in having: (1) a tendency to coppice from the root; (2) *leaves* with a blunt point; (3) *staminodes* not connate with the petals; (4) *style* at first deflexed; (5) *stigma* very much smaller; (6) *fruits* without horns.

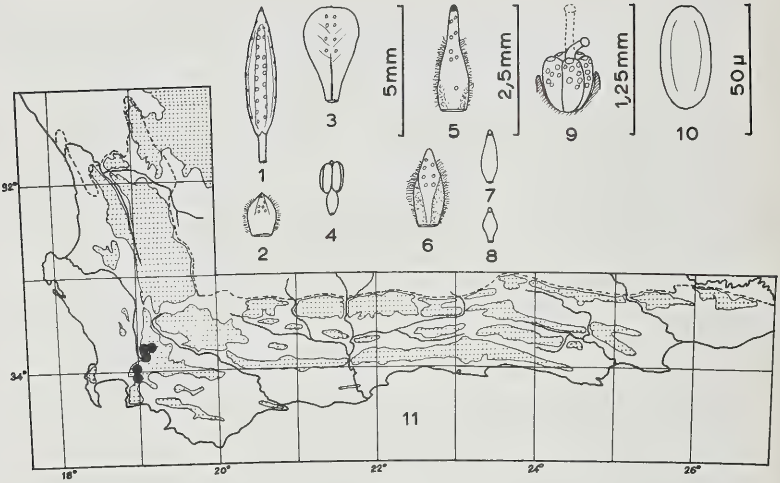

FIG. 3.
Coleonema nubigenum: 1, leaf. 2, calyx lobe. 3, petal. 4, anther. 5, bract. 6, bracteole. 7 and 8, staminodes. 9, gynoecium and disc. 10, pollen. 11, distribution.

2. **Coleonema juniperinum** Sonder in Fl. Cap. **1**: (1860). Type: Kleinhouwhoek, Caledon Division, *Zeyher 2150* (S, lectotype; SAM, isolectotype).

Coleonema juniperifolium Eckl. & Zeyh., Enum. Plant.: 106 (1835), nom. nud. Type: In lateribus montium Hottentotshollands et Hauhoeksberge (Stellenbosch). Ad montes Zwarteberg et Kleinriviersberge (Caledon). Aug. Sept. *E. & Z. 834* (C, G, S, SAM).

Coleonema virginianum Eckl. & Zeyh., Enum. Plant.: 106 (1835), nom. nud. Based on: Inter saxa (altit. IV) laterum montium prope Tulbagh (Worcester). Nov. *E. & Z. 835* (C, G, PRE, S, SAM, etc.). Non *Diosma juniperina* (Bartl. & Wendl.) Spreng. Syst. Veg. **1**: 784 (1825) = *Acmadenia juniperina* Bartl. & Wendl.

Shrubs 0,3–0,5 m tall, dense or if amongst other vegetation diffuse and sprawling, single-stemmed at base. *Branches* slender, tending to sprawl, variously bent, glabrous, smooth, longitudinally slightly wrinkled, reddish-brown. *Branchlets* numerous, extremely slender, virtually glabrous (most minutely puberulous at first), bright red, alternate. *Leaves* 5–7 mm long, 0,8 mm broad, linear-lanceolate, acute, mucronulate, glabrous, petiolate, alternate, adpressed erect, imbricate at first; hyaline margins thin, subserrulate, extremely narrow; abaxial surface convex with many gland-dots in two rows; adaxial surface flat when fresh. *Inflorescence* solitary, terminal or axillary towards the apices of the branchlets, about 3 mm diam., white. *Basal bracts* ±four, 0,6–0,7 mm long, 0,3–0,5 mm broad, lanceolate to ovate, mucronulate, ciliolate with broad translucent margins, glabrous; adaxially pubescent above. *Bracteoles* two, 0,8 mm long, 0,6 mm broad, elliptic, obtuse, ciliolate with broad translucent margins, glabrous, sacculate; midrib one or two gland-dotted, apex gibbous. *Calyx lobes* five, 1,1 mm long, 0,8 mm broad, oblong, obtuse; apex elevated, obtuse, reddened; margins ciliolate, broadly translucent; adaxial surface pubescent; abaxial surface glabrous, gland-dotted. *Petals* five, 2 mm long, 1,1 mm broad above narrowing evenly to the base, obovate, obtuse, minutely apiculate, glabrous; *blade* pappilose adaxially, sometimes pink-tipped outside; *claw* connate with the staminode below with a short elevated groove almost embracing the tip of the staminode and fitting neatly into the lateral grooves of the anthers before anthesis. *Staminodes* five, 0,7 mm long, fusiform, acute, glabrous. *Filaments* five, becoming 1,2 mm long, glabrous, acicular, elevating each anther in turn from between the petal ridges into the centre of the flower. *Anthers* five, 0,6 mm long, 0,4 mm broad, yellow; apical gland minute, sessile, globose. *Pollen* very variable, up to 33 μ long, 18 μ broad, elliptical with rather pointed ends. *Disc* obvallate, narrow, 5-lobed, green, exceeded by the ovary, nectariferous. *Stigma* 0,2 mm diam., capitellate. *Style* becoming 0,5 mm long, glabrous, erect. *Ovary* 5-carpellate, 0,6 mm long, 0,5 mm diam., glabrous, apices obtuse. *Fruit* 5-carpellate, 4,5 mm long, 4 mm diam.; *carpels* glabrous, multi-gland-dotted, reddened, strongly veined when dry; *horns* 0,5 mm long, spreading. *Seed* 3,1–3,3 mm long, 1,3–1,4 mm broad, black, shining; aril black.

Sonder, in describing *Coleonema juniperinum*, cites specimens collected by Ecklon and Zeyher from the mountains of the Hottentotsholland, Houhoek, Caledon Swartberg and Kleinrivier and from near Tulbagh. In particular he cites *Zeyher 2150* from Houhoek as being partly *C. juniperinum* and partly his var. β, a variety which appears to be indistinguishable from the original species. This sheet housed at Stockholm bears a label in Sonder's handwriting with the inscription "2150 Coleonema juniperinum Sdr., Klynhouhoek, Decbr., Zeyher". It consists of three twigs 250–340 mm long at the early fruiting stage and has been selected as the lectotype. Another sheet which Sonder undoubtedly examined has the very dubious locality "Table Mountain near Constantia". This consists of specimens in the flowering stage in good condition and bears a capsule containing portions of a flower with a description in Sonder's handwriting. The source from which Sonder appears to have derived his epithet *juniperinum*, "Diosma juniperina Spreng, Herb. Zey. 397" is a misidentification, Sprengel having made the new combination *D. juniperina* when he transferred all Bartling and Wendland's genera including *Acmadenia* back to *Diosma*. It should be noted that Drège's labels marked "Diosma virgata C. F. W. Meyer" are attached to the specimens of *C. juniperinum*.

Selected Specimens Examined

CAPE—3319 (Calvinia): Van Rhyns Pass summit, Vanrhynsdorp/Calvinia Division (-AC), 2 200 ft., 23/8/1972, *Williams 1676* (NBG, PRE); Lokenberg ridges W. of Themeda Valley, 2 m tall, Calvinia Division (-CA), 2 300 ft., 24/9/1955, *Leistner 418* (NBG, PRE).

—3318 (Vanrhynsdorp): Gifberg, 3–4 ft. tall, Vanrhynsdorp Division (-DD), 1–2 000 ft., 13/9/1911, *Phillips 7535* (BOL, PRE, SAM).

—3219 (Clanwilliam): Pakhuis Pass, along path to Heuning Vlei, 2–3 ft. tall, Clanwilliam Division (-AA), 2–3 000 ft., 29/9/1940, *Esterhuysen 3139* (BOL, NBG, PRE).

—3319 (Worcester): Inter saxa (altit. IV) laterum montium prope Tulbagh (-AC), –/11/–, *E. & Z. 835* (C, G, PRE, SAM), *Zeyher 77.11* (C, E, GRA); Summit of Pass above Kluitjieskraal, 0,25 m tall; Tulbagh Division, 2 000 ft., 8/11/1974, *Williams 1926* (NBG); Bainskloof, Worcester Civision (-CA), 3 700 ft., 14/11/1874, *Schlechter 9185* (BM, GRA, PRE); Dutoitskloofberg (-CA or -CD), 4 000 ft., 30/11/1827, *Drège III. A.e.* (BOL, BM, E, G, P); French Hoek, Paarl Division (-CC), 1 000 ft., 6/10/1964, *Compton 18555* (NBG); Stettynskloof, Worcester Division (-CD), 19/8/1961, *Barker 9466* (NBG); Jonaskop, at end of side road to stream, Worcester Division, 2 800 ft., 19/10/1971, *Williams 1561* (NBG, PRE); Scherpenheuwel, hillside, Worcester Division (-DA), 29/9/1951, *Barker 7525* (NBG); Jonaskop, N. slopes, Worcester Division (-DC), 4 500 ft., 25/9/1965, *Rycroft 2884* (NBG).

—3318 (Cape Town): Banhoek Valley, slopes of Drakenstein Mountains, Stellenbosch Division (-DD), –/12/1939, *Esterhuysen 1375* (BOL, NBG, GRA, PRE).

—3418 (Simonstown): Upper Lourens River Valley, Somerset West Division (-BB), 600 m, 30/10/1945, *Parker 4007* (NBG, PRE); In saxosis pr. Sir Lowrys Pass, Somerset West Division, 400 ft., 15/7/1892, *Schlechter 1110* (BM, G, GRA); Kogelberg, Caledon Division, 2 000 ft., 16/11/1944, *Compton 16453* (BOL, NBG); Hangklip, Caledon Division, 18/11/1944, *Compton 16499* (NBG).

—3419 (Caledon): Nieuweberg, Caledon Division (-AA), 2 500 ft., 26/8/1940, *Bond 498* (NBG, PRE); Groenlandberg, N. side, Caledon Division, 2 200 ft., 31/5/1973, *Williams 1811* (NBG); Kleinhouhoek, Caledon Division, *Zeyher 2150* (S, SAM); In rupestris mtis. Zwartberg pone Caledon (-AB), 1 000 ft., –/10/1886, *MacOwan H.N.A.A. 710* (BM, E, G, PRE, SAM); Zwartberg und Umgegend des Bades, Caledon, 1 000–2 000 ft., –/11/–, *Zeyher 3775* (E, G, S, SAM); Honingklip, Bot River, Caledon Division (-AC), 19/11/1955, *Taylor 4581* (NBG, PRE); Kleinrivier Mountains, Caledon Division, (-AD?), *Stokoe 7093* (PRE); 51.11, –/11/–, *Zeyher 3775* (E, G, S, SAM); Galgeberg/Bushmanskloof Pass, Robertson Division (-BA), 2 800 ft., 23/3/1972, *Williams 1631* (NBG, PRE, S), 24/9/1941, *Walgate 344* (NBG, PRE); Bei Genadendal, 2 500/3 500 ft., 28/10/1828, *Drège IV A* (G, P, S, SAM).

Without definite locality: In lateribus montium Hottentots-hollands et Houhoeksberge (Stellenbosch). Ad montes Zwartberg et Kleinriviersberge (Caledon). Aug. Sept. *Ecklon & Zeyher 834* (C, G, S, SAM), *Thunberg 5708* (UPS), *Masson s.n.* (BM, G), *Niven 64* (BM), *Roxburgh s.n.* (BM), *Verreaux s.n.* (BM, G).

With locality doubtful: Elim, 300 ft., 25/4/1896, *Schlechter 7733* (BM, E, G, GRA, PRE, PH, S).

DISTRIBUTION, VARIATION AND BIOLOGY

C. juniperinum is mainly found in the Caledon and Worcester divisions and concentrates towards the south western corner of this area. There is an extraordinary disjunction towards the north, a distance of about 130 kilometres, before the species reappears between Clanwilliam and Nieuwoudtville in a much more arid environment. No variation in the floral parts has been observed but plants from the northern populations appear to be more rigid, rather prickly, and taller, while the leaves tend to be more spreading. Within the Kogelberg area at the south western corner of the Caledon division, plants have been found with leaves that are more obtuse at the apex *(Compton 16453)*.

The small open flowers with sticky pollen and the disc exuding nectar are undoubtedly pollinated by insects. Although the plants may produce many stems at the surface of the ground, they do not appear to coppice after fires and so regeneration can only take place from seed which is ejected in the usual way by a catapult mechanism when ripe. Buds start forming in April and May with flowering continuing until November. Fruiting appears to last from September until March. The leaves when crushed have a faint resinous smell of pine or cedar.

DISCUSSION

The following characters serve to place this species in the genus *Coleonema*; at the same time they exclude it from any other genus of the *Diosmeae*: (1) *flowers* solitary, terminal or axillary, each with several basal bracts; (2) *petal* with an elevated groove enclosing the apex of the staminode, connate with the staminode below; (3) *anther* with a minute apical gland; (4) *disc* obvallate, thinly lobed, exceeded by the ovary; (5) *stigma* capitellate; (6) *style* and *filaments* short, glabrous, erect; (7) *ovary* 5-carpellate.

Coleonema juniperinum is a distinct species with small white flowers, 3–4 mm diam., the smallest in the genus; with petals pappilose; with slender filiform branchlets and small leaves showing only two rows of gland dots.

3. **Coleonema calycinum** (Steud.) Williams, comb. nov.

Diosma calycina Steud. in Flora **34**: 549 (1830). Type: Pr. bon. sp. *Ludwig 550* (PH, lectotype).

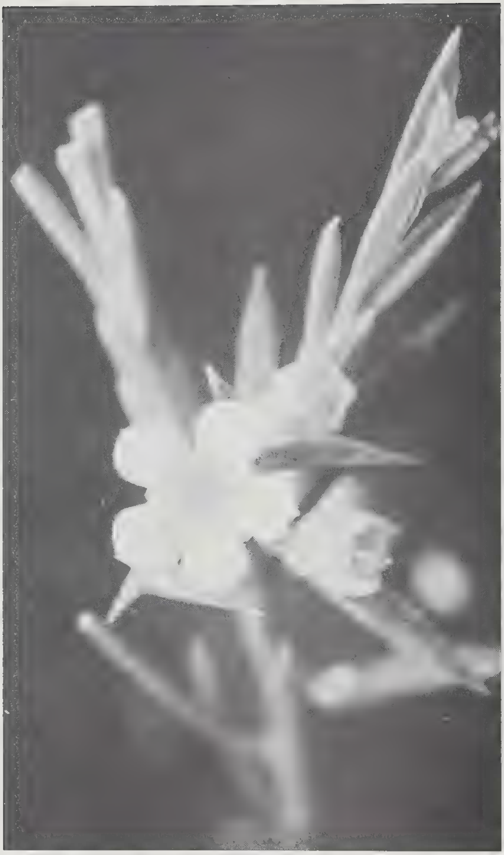

Fig. 4.
Coleonema juniperinum: flower, 3 mm diam.

Coleonema album var. *gracile* Schlechtendal in Linnaea **6**: 199 (1831).

Coleonema gracile (Schlechtendal) Eckl. & Zeyh., Enum. Plant.: 106 (1835). Type: In locis umbrosis et apertis aridolapidosisis laterum montis Baviaansberg prope Genadenthal (Caledon) Nov. *Ecklon & Zeyher 833* (C, SAM).

Diosma tenuifolia Presl., Bot, Bem.: 31 (1844) nom. nud.

Diosma oppositifolia sensu Drège in Zwei pflanz. Doc.: 174, 115 (1844) in error.

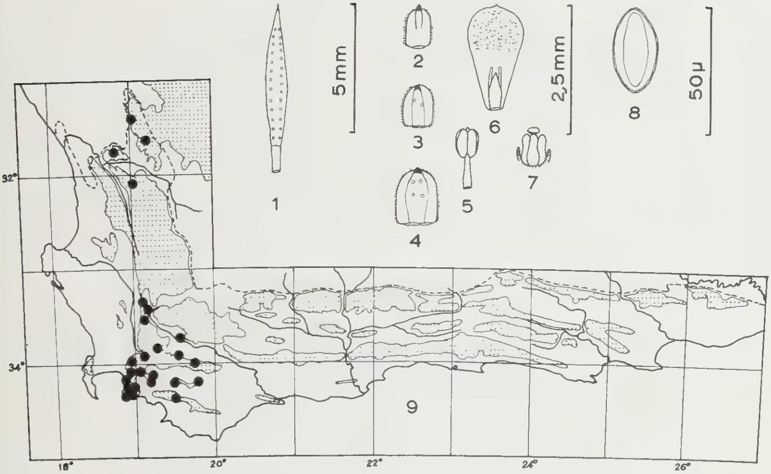

FIG. 5.
Coleonema juniperinum: 1, leaf. 2, uppermost bract. 3, bracteole. 4, calyx lobe. 5, anther. 6, petal with staminode. 7, gynoecium and disc. 8, pollen. 9, distribution.

Shrubs from (*Williams 2027*, 3/8/1975) 1,7–2,7 m, erect, single-stemmed at ground level, forming a large bush. *Branches* erect, numerous, glabrous, alternate; bark transversely marked with leaf scars. *Branchlets* erect, slender, numerous, alternate, minutely puberulous, not hidden by the leaves. *Leaves* 13–19 mm long, 0,7–1 mm broad, linear, acute, glabrous except up the middle of the adaxial surface where sometimes sparsely puberulous, alternate, spreading-erect; hyaline margins narrow, minutely and somewhat sparsely serrulato-ciliolate; abaxial surface convex with two rows of gland dots. *Inflorescence* solitary, terminal or axiliary; buds sometimes pinkish; *flowers* 5,5–6,5 mm diam., white, standing open, pedicellate. *Bract* the uppermost of about seven adpressed scales which increase in size towards the calyx, 1,2 mm long, 0,9 mm broad, sub-deltoid, glabrous; midrib gland-dotted above with a sharp point; margins broadly translucent, ciliate. *Bracteoles* two 1,2 mm long, 0,9 mm broad, orbicular, glabrous, apex with a sharp or a rounded point; margins broadly translucent, ciliate; adaxial surface pubescent in the middle above. *Calyx lobes* five, 1,2 mm long, 1,2 mm broad, deltoid, obtuse-sacculate, with a gland at the apex, or acute with a sharp point, glabrous; margins broadly translucent, ciliate; adaxial surface pubescent towards the midrib. *Petals* five, 3,5–4,5 mm long, obovate, white, soon delapsing; *limb* 1,9–2.4 mm broad, spreading, with or without one or two hairs and gland dots; *claw* narrowing to the base, connate with the staminode below and with an elevated groove enfolding the upper part of the staminode. *Staminodes* five, 1,7 mm long, partly connate with the petal; apex with a small gland. *Filaments* five, 1,9 mm long, glabrous, acicular. *Anthers* five, before anthesis 0,7 mm long, 0,6 mm broad, yellow; apical gland minute, sessile, globose. Pollen 45 μ long, 22 μ broad, ellipsoid. *Disc* 10-sinuate, narrow, green, equalling the top of the stigma at first and exceeding the ovary by a long way. *Stigma* 0,3 mm diam., capitate, depressed globose. *Style* 5-carpellate, 0,8 mm diam., glabrous; carpels with globose apices. *Fruit* 5-carpellate, 4,5 mm long; *carpels* glabrous, multi-gland-dotted; *horns* 1 mm long or less, spreading at 45 °. *Seed* (from *Williams 2239*, 9/11/1976) 3–3,5 mm long, 1,4–1,6 mm broad, black, shining; aril with a black skin over the apex.

The material that Steudel worked on was probably destroyed during the 1939/45 war and so the very poor fragment of Baron von Ludwig's collection, preserved in the herbarium of the Academy of Natural Sciences at Philadelphia, has been chosen as the lectotype.

It was customary for travellers, including many botanical collectors, to make the mission station at Genadendal one of their stops and as a result of this, *C. calycinum* was collected by Baron von Ludwig, by Ecklon, by Drège and others in the first half of the nineteenth century. After that it was only collected once more, about a hundred years later, by Dr K. H. Barnard of the South African Museum. Recent extensive searches have failed to discover it in this area which has been repeatedly ravaged by fires and almost completely overrun by invasive alien plant species. As a result the description above is based almost entirely upon specimens collected from Windhoek in the limestone hills near the De Hoop Vlei in the Bredasdorp Division.

SPECIMENS EXAMINED

CAPE—3319 (Worcester): Boschiesveld Mtns., Worcester side (-CD), 1/10/1955, *Stokoe s.n.* (SAM); higher slopes near trig. beacon MI–ER152 between Villiersdorp and McGregor, Worcester Division, 2 300 ft., 17/10/1973, *Taylor 8624* (STE); Ouhangsberg, above Hammanshof, Worcester Division, 2 575 ft., 18/9/1977, *Williams 2350* (NBG).

—3320 (Montagu): Kloof at base of Leeuriviersberg, Swellendam Division (-CD), 17/5/1958, *Esterhuysen 27753* (BOL, BM, BR, C, E, G, K, L, M, MO, NBG, PRE, STE), 1/9/1958 *Esterhuysen 27875* (BOL, BM, BR, C, E, G, K, L, M, MO, NBG, PRE, STE); Warmwatersberg, south side near Barrydale (-DC), 3 200 ft., 4/12/1974, *Williams 1943* (NBG).

—3419 (Caledon): in shady and open dry stony places on the slopes of the Baviaansberg mountain near Genadendal, Caledon Division (-BA), 1 000–1 500 ft., –/10/–, *Ecklon & Zeyher 833* (C, SAM); Genadendal in the Baviaanskloof and on the mountain in rocky places usually a little shady and damp, 1 000

–2 000 ft., –/10/–, *Drège IV.A.8* (BM, E, G, K, SAM); by the side of the stream in the Baviaanskloof, Genadendal, –/10/1864, *Prior s.n.* (K); Genadendal, –/–/1854, *Roser s.n.* (PRE), *Barnard s.n.* (SAM); Houhoek (-AA), –/12/–, *Zeyher s.n.* (SAM).

—3420 (Bredasdorp): Kathoek, Bredasdorp Division (-AD), 300 ft., *Acocks 22754* (K, PRE); De Hoop, Bredasdorp Division, less than 200 m, –/9/1969, *v.d. Merwe 1123* (PRE); Windhoek, N. end of De Hoop vlei kloof, Bredasdorp Division, 76 m (250 ft.), 3/8/1975, *Williams 2027* (NBG), 9/11/1976, *Williams 2239* (NBG): Potberg Nature Reserve, flats on top of Potberg, Bredasdorp Division (-BC), 470 m, 18/10/1978, *Burgers 1453* (CPA Nat. Cons. Herb.).

—3321 (Ladismith): Kampscheberg, Riversdale Division (-CC), 3–4 000 ft., –/10/1926, *Thorne s.n.* (SAM *38844*).

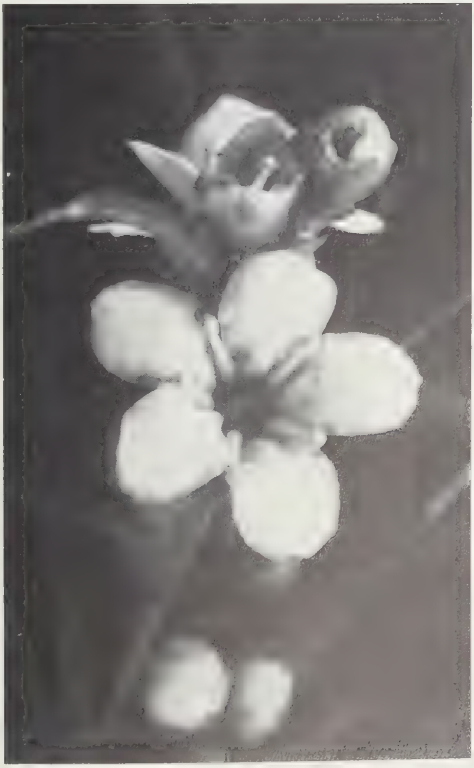

FIG. 6.
Coleonema calycinum: flower, 5,5 mm diam.

Distribution, Biology and Variation

C. calycinum is found in what appear to be isolated relict populations which are rather widely separated from each other. These are on the Warmwatersberg, the Langeberg, the Riviersonderend mountains, the Bredasdorp limestone hills and the Potberg. In most cases the plants grow on south-facing slopes at the base of rocky cliffs.

Flowering would seem to be at its height from September to October with seeds ripening in November and December. Pollination is no doubt effected by insects which are attracted in swarms to the plants. Regeneration can only take place from seed as there is no evidence of any persistent rootstock. One plant 1,7 m tall with a stem diameter of 46–52 mm showed about 24 annual growth rings. The plant gives off a pleasant smell reminiscent of bay rum.

Plants from near the Bredasdorp Division exhibit calyx lobes with the apex obtuse-sacculate, whereas those from further inland have the apices of the calyx lobes acute with a sharp point. Buds may have a pinkish tinge, particularly noticeable in the Potberg population. The type specimen and some of the material collected by Ecklon have leaves rather more widely spaced and longer than normal but this may perhaps be due to etiolation.

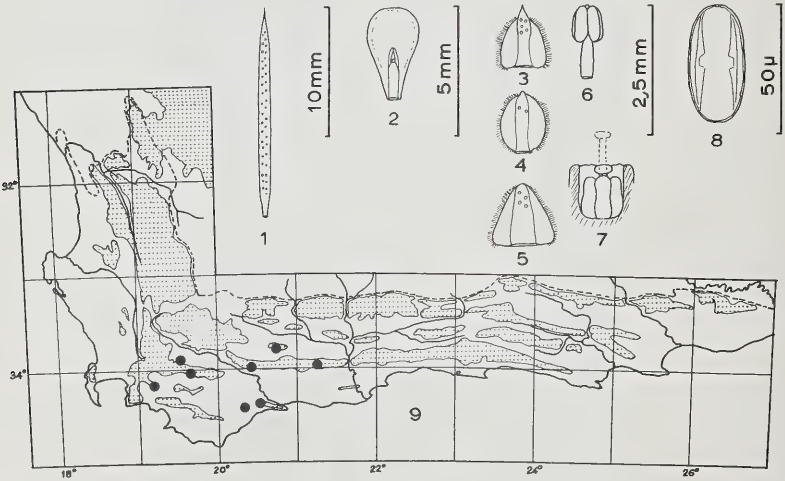

Fig. 7.
Coleonema calycinum: 1, leaf. 2, petal with staminode. 3, uppermost bract. 4, bracteole. 5, calyx lobe. 6, anther. 7, gynoecium and disc. 8, pollen. 9, distribution.

Discussion

Although plants of *C. calycinum* may be found with pink buds, the flowers appear white when open. It is distinguished by having: (1) *leaves* 13–19 mm long; (2) *calyx lobes* 1,2 mm long; (3) *petals* obtuse and *staminodes* connate with the petal in the lower half.

4. **Coleonema album** (Thunb.) Bartl. & Wendl., Diosmeae in Beitr. Bot. **1**: 56 (1824).

Diosma alba Thunb., Prodr. Plant. Cap. **1**: 84 (1794); Diss. Diosm.: 376 (1797); Flor. Cap. **2**: 126 (1818); Flor. Cap. ed. Schult.: 221 (1823). Type: *Diosma alba* ∝, e. Cap. b. Spei, *Thunberg* (UPS–THUNB. *5657*, holotype).

Adenandra alba Roem. & Schult., Syst. Veg. **5**: 452 (1819).

Diosma rubra L. Sp. Pl. **1**: 198 (1753) ex parte, as to L. hand spec. on sheet *240/4* in herb. Linn.

Diosma rubra L. sensu Berg. Plant. Cap.: 62 (1767) exclus. syns. nom. superf.

Coleonema rubrum (L.) Druce in Rep. botl. Soc. Exch. Club Br. Isl. 1916: 616 (1917)

Diosma ericoides L. Sp. Pl. **1**: 198 (1753) ex parte as to syn. Ray?; Ait. Hort. Kew. **1**: 275 (1789); Roem. & Schult. Syst. Veg. **5**: 455 (1819) ex parte; Sims in Curtis's Bot. Mag. 2322 (1822).

Diosma juniperifolia Salisb. Chap. All.: 142 (1769), nom. superf. Type: as for *Diosma rubra* L.

Icones: Mill. Gard. Dict. Fig. Plant. t.124, f.2 (1756); Sims in Curtis's Bot. Mag. **49**. f.2332 (1822); Bartl. & Wendl. in Beitr. Bot. **1**. t.A, f.3 (1824); Juss. in Mém. Mus. Hist. Nat., Paris **13**. t.19, f.17 (1825); Ballion Hist. Pl. **4**: 383, 384 (1873); Engl. Pfanzenfam. **3**. 4. f.126, A-K (1896); Kidd, Wild Fl. Cap. Pen. pl. 43, f.4 (1950); Mason, W. Cape Sandveld Flow. pl. 60, f.7 (1972).

Shrubs to 1 m tall, dense, branching from the base. *Branches* spreading, variously bent, glabrous; *bark* greyish-brown, rough with horizontal leaf scars. *Branchlets* fairly numerous, erect, slender, densely puberulous, purplish, not hidden by the leaves except near the tips of new shoots, bark soon splitting decurrent from either side at the base of each petiole. *Leaves* 12–13,5 mm long including the petiole 1 mm long, 1,3–1,5 mm broad, oblanceolate-linear, acute, sharply mucronate, alternate, spreading, sometimes slightly recurved; hyaline margins narrow, denticulate or serrulate; adaxial surface somewhat convex when fresh, minutely puberulous along the middle towards the base; abaxial surface convex, 5-striped with 2 rows of gland dots and a few more scattered towards the margins. *Inflorescence* solitary, axillary, crowded towards the apices of the branchlets, the uppermost often terminal; buds pinkish tinged; flower 6–7 mm diam. *Bracts* numerous, as many as ten counted including 2 bracteoles, much reduced, some readily delapse, more or less in pairs as to size, increasing in size towards the calyx, penultimate pair 1,5 mm long, 0,9 mm broad, broadly lanceolate, acute with a sharp mucro; adaxially puberulous; abaxial surface glabrous, gland-dotted; margins broadly translucent, ciliolate. *Bracteoles* two, the uppermost pair of bracts are significantly the largest and may be referred to as bracteoles, 2 mm long, 1,3 mm broad, lanceolate, acute, sharply mucronate, adaxially pubescent in the middle above, abaxially glabrous, gland-dotted; margins broadly translucent, ciliate. *Calyx lobes* five, 2,5 mm long, 1,2 mm broad, oblong-lanceolate, acute with a minute sharp mucro; adaxial surface concave, puberulous in the middle above; abaxial surface glabrous, gland-dotted on the midrib towards the apex; margins broadly translucent, ciliate. *Petals* five, 4,8 –5,1 mm long, *limb* 3 mm long, 1,9–2,1 mm broad, white, spreading, obovate, somewhat apiculate, glabrous; *claw* 2 mm long, narrowing evenly to the base, glabrous, with two elevated ridges up the middle of the adaxial surface about 0,4 mm apart forming a raised groove narrowing above. *Staminodes* five, 2 mm long, 0,3 mm broad, glabrous, with a minute pointed apical gland, connate with the petal except for 0,5 mm at the apex where free but lying within the groove of the petal. *Filaments* five, becoming 2,5 mm long, glabrous, acicular, erect. *Anthers* five, before anthesis 1,2 mm long, 0,7 mm broad, yellow with a minute globose apical gland. *Pollen* 47 μ long, 27 μ broad, ellipsoidal. *Disc* sinuate, closely surrounds the ovary but never exceeds it, dark green, exudes nectar. *Stigma* 0,3 mm diam., capitellate, green, at first just equalling the tips of the lobes of the ovary. *Style* becoming 1 mm long, glabrous, erect. *Ovary* 5-carpellate, 1 mm long, 0,9 mm diam., glabrous, minutely gland-dotted; apices oblong, obtuse with a large round immersed gland above facing outwards. *Fruit* 5-carpellate, 7 mm long overall, 5 mm diam., glabrous, lumpy with gland dots, midrib prominent, green lips between adjacent carpels pressed tightly together; *horns* 2 mm long curving upwards with an immersed gland at the tip. *Seed* 3–4 mm long, 1,6–1,9 mm broad, black, shining; aril black crested.

The holotype collected by Thunberg at the Cape of Good Hope is preserved in Thunberg's herbarium at Uppsala. It consists of three twigs mounted on sheet No. 5657 inscribed *Diosma alba* ∝ in Thunberg's handwriting with *e. cap. b. spei. Thunberg*. written on the back of the sheet. An adjacent sheet No. 5658 inscribed *Diosma alba ?* β. bears two twigs of what appears to be *Diosma aspalathoides* Lam. According to Aiton's *Hortus Kewensis* (1789) this species, under the name of *Diosma ericoides*, was in cultivation in 1756 by Mr Philip Miller who was in charge of the Chelsea Physick Garden at that time.

Both *Diosma rubra* L. and *Diosma ericoides* L. which apply in part to *Coleonema album*, have been a long standing source of confusion. To this day *Coleonema album* is marketed under the name of *Diosma ericoides* in New Zealand. Salisbury did not care for the name *Diosma rubra*, saying that it was inappropriate and substituted the name *Diosma juniperifolia* which he said was better.

SPECIMENS EXAMINED

CAPE—3318 (Cape Town): Saldanha Bay, Constable Hill, S.E. slope

(-AA), 26/4/1949, *Macnae 1075* (BOL); Langebaan Lagoon, 30/5/1972, *Axelson 566* (NBG); Table Mountain, Cape Peninsula (-CD), 10/11/1827, *Ecklon 239* (C, G, S), *Ecklon & Zeyher 831* (C, G, PRE, SAM), 1 000–2 000 ft., 28/7/1826, *Drège 7137* (PRE, K), *7138* (P), *7139* (G, P, S), –/6/1829, *Verreaux s.n.* (G), 2 000 ft., –/8/1883, *MacOwan H.N.A.A. 48* (BOL, BM, G, GRA), 30/11/1926, *Lynes s.n.* (BM), 23/9/1883, *Wilms 3019* (G), –/11/1919, *Rogers 17450* (G); amongst rocks above Postern Buttress, 2 500 ft., –/8/1938, *Esterhuysen s.n.* (BOL *23265*); Camps Bay, 11/8/1927, *Salter 245/9* (BM), 25/8/1917, *Stopford 57* (BM), –/12/1928, *Maude s.n.* (BM), 800 ft., –/11/1897, *Galpin 3852* (GRA, PRE); Stinkwater, 1875/1880, *Rehmann 1339* (BM), 18/8/1883, *Wilms 3108* (BM); above Kirstenbosch, 25/9/1952, *Salter 9482* (BM).

—3418 (Simonstown): rocky slopes of Little Lions Head, near Hout Bay, Cape Peninsula, (-AB), –/7/1939, *Esterhuysen s.n.* (BOL *23264*, PRE); Llandudno, 18/9/1943, *Compton 14826* (NBG); Hout Bay, 17/8/1940, *Compton 9170* (NBG); Muizenberg Mt., –/7/1838, *Krauss s.n.* (G), 1 800 ft., –/12/1880, *H. Bolus 2741* (BM); Fish Hoek Valley, 18/8/1883, *Wilms 3108* (BM); Noordhoek, –/9/1929, *Dame Alice and the Misses Goodman 341* (BM), –/10/1929, *Dame Alice and the Misses Goodman 878* (BM); Kalk Bay Mt., 16/10/1946, *Barker 4205* (NBG); Kommetjie hills, 20/9/1949, *Barker 5897* (NBG); Schusters Bay, 30/10/1940, *Barker 1154* (NBG); Klaver Valley near Simonstown, 10/11/1933, *Barker s.n.* (BOL); in campes. et collibus prope Simonsbay frequens, –/10/1801, *R. Brown ? s.n.* (BM); Olifantsbosch, W. coast of Cape Peninsula (-AD), 7/10/1956, *Chamberlain 41* (BM); Steenbras Mouth, Somerset West Division (-BD), 6/9/1947, *Compton 13581* (NBG); Harold Porter Reserve, Caledon Division, 16/10/1963, *Martin 761* (NBG);

—3419 (Caledon): Sandbaai, Caledon Division (-AC), 29/9/1963, *Walters 209* (NBG); Hermanuspetersfontein, Caledon Division, 200 ft., –/7/1896, *F. Guthrie s.n.* (BOL), 50 ft., –/7/1896, *Bodkin s.n.* (BOL), 100 ft., –/9/1901, *H. Bolus 9855* (BOL); Voëlklip, Hermanus, near Mossel River Mouth, Caledon Division (-AD), 0–50 ft., 6/8/1971, *Williams 1500* (NBG), 10 m, 19/8/1975, *Williams 2047* (NBG), 11/11/1978, *Williams 2640* (NBG); Vogelgat Kloof, Caledon Division, 100 ft., 9/10/1978, *Williams 2602* (NBG); Gansbaai, Caledon Division (-CB), sea level, 13/10/1964, *Walters 279* (NBG); Franskraal Mtns., 14/4/1951, *Maguire 2639* (NBG); Brandfontein, amongst rocks along the coast, Bredasdorp Division (-DD), 15/10/1951, *Esterhuysen 19100* (BOL).

—3420 (Bredasdorp): amongst rocks at summit of ridge on S. side of Bredasdorp Mountain (-CA), 15/10/1951, *Esterhuysen 19150* (BOL); near Cape Infanta, rocky coast (-BD), 28/9/1959, *Esterhuysen 28323* (BOL).

Without precise locality: e. Cap. b. Spei. *Thunberg s.n.* (B-W 4729/1, C, LINN-Smith's Herb. *397.6*, UPS-THUNB. *5657*), C.B.S. *Lehmann s.n.* (BM), *Niven s.n.* (BM), *Roxburgh s.n.* (BM, G), *Stanger s.n.* (BM), *Harvey 452* (BM), *Bowie 47* and *50* (G), Swellendam, –/9/1827, *Verreaux s.n.* (G), –/10/1827, *Ver-*

reaux s.n. (G), *Diosma rubra 3.* as to L. hand specimen (LINN *270.4*), as to L. hand specimen (LINN *270.5*), (LINN *270.8*), *Diosma rubra* (LINN-Smith's Herb. *397.5.1), Diosma alba* (LINN-Smith's Herb. *397.6).*

DISTRIBUTION AND BIOLOGY

Coleonema album appears to be very much a coastal plant, well able to withstand the strong winds which frequently blow in from the sea. The only population at any great distance from the sea lies at the southern end of the Bredasdorp Mountains about 19 km from the coast. Plants are found growing amongst outcrops of rocks of the Table Mountain Sandstone Series or of the underlying Cape Granite but never upon the coastal limestone of the Bredasdorp Series. The main population centre appears to be the Cape Peninsula. There is an outlier 95 km to the north at Saldanha Bay and a fairly even distribution along the coast from the Steenbras River Mouth to Gansbaai. From there eastwards there are isolated populations at Brandfontein, Bredasdorp and a final outlier 77 km still further to the east at Cape Infanta. Plants grow at sea level and at all altitudes up to a maximum of 750 m (2 500 ft.) on Table Mountain. The plants may form dense stands in coastal scrub. One plant 1,8 m tall showed about 25 growth rings. Flowering takes place mainly from August to October and ripe fruits may be found up to the end of November. The conspicuous white flowers and the nectariferous disc indicate that pollination is most probably effected by insects. The seeds when ripe are ejected by the usual catapult mechanism and regeneration takes place only from seed and usually only after fires. The leaves, when crushed, have a characteristic sweet smell but the scent of the flowers is not so pleasant. Most plants are parasitised by a gall insect which gives rise to a characteristic little conelike collection of leaflets often making herbarium material very easy to recognise.

No significant variation and no hybridisation have been observed.

DISCUSSION

In 1824 when Bartling and Wendland proposed the new genus *Coleonema, Diosma alba* Thunberg was the only species of *Coleonema* then known to science. The characters that distinguished it from species in other genera of the *Diosmeae* were stated by them as: (1) *calyx* 5-partite; (2) *hypogynous disc* not very free at the margin; (3) *petals* narrowed below, longitudinally grooved; (4) *filaments* 10, 5 fertile equalling the calyx, 5 sterile filiform, glabrous, connate within the groove of the petals; (5) *anthers* subrotund, gland adnate; (6) *style* short; (7) *stigma* capitate.

Coleonema album may be distinguished from all other species by having the (1) *staminode* mostly connate with the petal; (2) *flowers* white, 6–7 mm diam.; (3) *leaves* 12–13,5 mm long. The presence of a small conelike *gall*, found only in this species, is a useful character for identification.

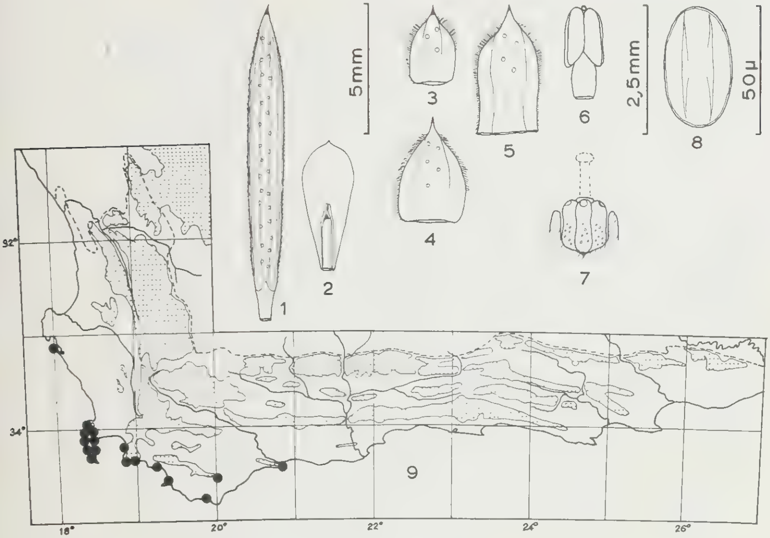

FIG. 8.
Coleonema album: 1, leaf. 2, petal with staminode. 3, uppermost bract. 4, bracteole. 5, calyx lobe. 6, anther. 7, gynoecium and disc. 8, pollen. 9, distribution.

5. **Coleonema aspalathoides** A. Juss. ex Don, Gard. and Bot. **1**: 783 (1831). Type: *Diosma aspalathoides* herb. Burm. non Lam. *Le Valliant? s.n.* (G. lectotype; P-JUSS *12 917* portion of lectotype).

(Coleonema) D. aspalathoides A. Juss. in Mém. Mus. Hist. Nat., Paris **13**: 471 (1825), nom. nud.

Coleonema aspalathoides Juss. ex Sond. in Fl. Cap. **1**: 378 (1860). Type: as above.

Coleonema dregeanum Presl., Bot. Bemerk: 31 (1844). nom. nud. Type: Zuurbergen, grassy heights near Strubels, 3 000 ft., 7/11/1829, *Drège 2251* (BM, G, K, S).

Shrubs forming dense stands, 0,5–1,3 m tall, dense, bushy, branching from near the base. *Branches* numerous, fairly erect, not very straight, glabrous, smooth, reddish-brown. *Branchlets* very numerous, very slender, erect, minutely puberulous, not hidden by the leaves. *Inflorescence* solitary, terminal on very short branchlets that may be so reduced and numerous that the flowers appear to be axillary and/or crowded into spikes; flowers 8–10 mm diam., petals pink, throat open, subtended by several reduced leaves. *Leaves* up to 12 mm long, perhaps slightly longer in young plants, 1–1.2 mm broad, linear-oblong, acute glabrous, dark green, alternate, spreading-erect; apex often reflexed with a sharp point about 1 mm long; narrowed at the base to a reddish petiole about 1 mm long; margins narrowly translucent, minutely serrulate; abaxial surface rounded, irregularly gland-dotted in two rows towards the midrib. *Bract* 1,6–1,8 mm long, 0,8–1 mm broad, ovate, acute, recurved-apiculate, partly puberulous; margins ciliolate, broadly translucent; gland-dotted towards the midrib. *Bracteoles* two, 1,7 mm long, 1 mm broad, ovate, acute, apex elevated, margins ciliate, broadly translucent, pubescent above to either side of the midrib. *Calyx lobes* five, 2,5 mm long, 1,3 mm broad, sub-ovate, apex tapering with a long sharp reddened recurved point; margins broadly translucent, villous-ciliate; abaxial surface puberulous to either side of the midrib; adaxial surface minutely pubescent at the middle. *Petals* five, 5,5 mm long, 2,2 mm broad, obovate, apiculate, narrowing evenly to the base; limb pink, spreading; *claw* sparsely ciliolate, sparsely pubescent below and at the apex of the staminode. *Staminodes* five, 2 mm long, 0,4 mm broad, linear, white, obtuse with a minute yellowish apical gland 0,1 mm long, connate with the claw of the petal below but not enfolded. *Filaments* five, becoming 2,3 mm long after anthesis, glabrous, subulate. *Anthers* five, 1 mm long, 0,7 mm broad, orange-yellow with a minute pointed apical gland. *Pollen* 42 μ long, 25–30 μ broad, spherical to sub-cylindric. *Disc* obvallate, thin, dark green, exceeding the ovary. *Stigma* 0,65 mm diam., depressed globose, capitate. *Style* becoming 1 mm long, erect, glabrous, rather slender. *Ovary* 5-carpellate, 0,8 mm long, 0,7 mm diam., glabrous, apices globose. *Fruit* 5-carpellate, 4,5 mm long, 3,5 mm diam., carpels glabrous with a prominent midrib and lateral ribs; *horns* 1 mm long, erect, apex somewhat hoof-shaped. *Seed* 2,5 mm long, 1,2 mm broad, black, shining; aril brownish.

The description given by Don (1831) of *Coleonema aspalathoides* agrees very well with the type which he cited (*Diosma aspalathoides* herb. Burm. but not of Lam.) with the one exception that he gives the colour of the flowers as white whereas in fact the flowers are always pink. This discrepancy can be explained as follows: the type specimen in the Burman herbarium (now at Geneva) was at the time in the Delessert herbarium in Paris. It was examined by Adrien de Jussieu who detached a small fragment which he placed in his own herbarium (P-JUSS *12 917*). Don studied de Jussieu's work on the Rutaceae (1825) and must have examined one or other of the specimens of *D. aspalathoides*. As this species was never in cultivation, Don could only base his description upon the dried type material, then nearly 50 years old when he saw it, and, knowing only *Coleonema album* with white flowers, must have presumed that his plant also would have white flowers.

With regard to the specimen in Burman's herbarium at Geneva, we can presume that this material came into his possession after 1786 (the date of publication of Lamarck's *Encycl. Meth. Bot.* which he cites) and before his death in

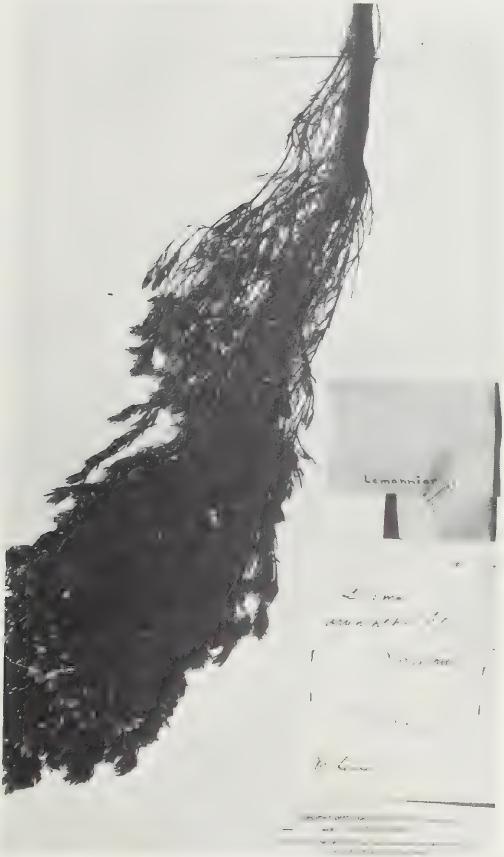

FIG. 9.
Coleonema aspalathoides: lectotype in Burman's herbarium at Geneva.

1793. It is possible that the words "Cap. Le V." (Fig. 9) written on the label by Burman refer to collection by *Le Valliant* who returned to Holland from the *Cape* in 1784. Some person has attributed the specimen to *M. Lemonnier*, apparently reading *Cap. Le V.* as *Cap. Le M.*, Louis Guillaume Le Monnier Professor at the Jardin des Plantes from 1758 to 1785 but who could never have collected at the Cape. This specimen in Burman's herbarium at Geneva, a single branch about 350 mm long, having been cited by both Don and de Jussieu, is therefore chosen as the lectotype.

SPECIMENS EXAMINED

CAPE—3323 (Willowmore): Foothills of Kouga Mtns. at Braam River near Joubertina, Uniondale Division (-DB), 28/10/1949, *Esterhuysen 16330* (BOL, NBG); Joubertina, Uniondale Division (-DD), –/7/1942, *C. J. Esterhuysen s.n.* (BOL, NBG).

—3324 (Steytlerville): Kouga Mtns. near Kouga Peak, lower E. slopes, Uniondale Division (-CA), 14/11/1944, *Esterhuysen 10802* (BOL, GRA, NBG); Kouga River, on road to Nooitgedacht, Humansdorp Division (-CC), 1 000 ft., 26/8/1975, *Williams 2060* (NBG, S); Kromme River (-CD), *Niven? 21* (BM, S); Assegaibosch, Humansdorp Division, 900–1 000 ft., 1/8/1912, *Rogers 2853* (BOL, GRA, SAM); Zuuranys Pass above Karreedouw, Humansdorp Division, 1 200 ft., 8/9/1973, *Thompson 1817* (K); Kromme River, N. of Assegaibosch, Humansdorp Division, 900 ft., –/5/1923, *Fourcade 2605* (K); Kromme River, W. of Humansdorp, 400 ft., 11/9/1960, *Acocks 21477* (K, NBG); Tuschen Bij, Humansdorp Division, 1 200 ft., –/9/1909, *Fourcade 5649* (BOL, GRA).

—3325 (Port Elizabeth): Bassonskloof, Annies Villa, Somerset East Division (-BD), 3 000 ft., 11/8/1965, *Bayliss 2950* (NBG); Suurberg Pass, Somerset East Division, 3 000 ft., 13/8/1973, *Bayliss 5895* (NBG); Zuurbergen, grassy heights near Strubels, 3 000 ft., 7/11/1829, *Drège 2251* (BM, G, K, S).

—3420 (Bredasdorp): 125.10, In collibus ad Rietkuil, Swellendam (-BA), –/10/–, *Zeyher 2159* (C, G, GRA, K, P, PRE, S, SAM, TCD); On farm Uitvlugt, Heidelberg Division, 14/9/1962, *van Breda 1582* (K, PRE); N. of Verkykerskop, Heidelberg Division, 750 ft., 21/1/1975, *Williams 1954* (NBG); Verkykerskop, S. side on Soutkloof, Heidelberg Division, 750 ft., *Williams 2023* (NBG, S); Heidelberg Division, –/7/1939, *Leipoldt 3358* (BOL, GRA, NBG, PRE); Potberg, W. Base, Bredasdorp Division (-BC), 13/10/1940, *Pillans 9347* (BOL, G, NBG, PRE).

—3421 (Riversdale): Hills near Riversdale (-AB), 400–600 ft., –/7/1923, *Muir 2970* (GRA, PRE); Plaatjieskop, Riversdale Division, 240 m, 3/5/1974, *Williams 1897* (NBG, PRE, S).

Without precise locality: *Roxburgh s.n.* (BM), *Bowie 101* (BM), *Thunberg s.n.* (S), *Le Valliant? s.n.* (P-JUSS *12 917*, G).

DISTRIBUTION AND BIOLOGY

Coleonema aspalathoides is found at altitudes varying from 120 to 900 m above sea level. The distribution is split into three areas with very large disjunctions, the total distance from east to west being about 500 kilometres. At the western end, towards Swellendam, relic populations are found on a few isolated silcrete-capped hills surrounded by soils derived from the Bokkeveld shales; the central populations appear to be associated with the Table Mountain Sandstone and in the east on the Suurberg Pass one finds the plants growing on soils derived from the Witteberg series. In spite of these differences in altitude, distance and soils no appreciable variation has been noted in the species.

The wide-open flower with its dark green disc and sticky pollen leads one to assume that it is most probably pollinated by insects. The plants are destroyed by fires and regeneration can only take place from seed which is ejected by the usual catapult mechanism when ripe. Flowering has been observed at different localities from April until November and ripe fruits in October and November. The leaves are not strongly or sweetly scented but the fruits when crushed have the strong smell of amylacetate.

DISCUSSION

The following characters when considered together definitely place this plant in the genus *Coleonema* and exclude it from any other genus of the *Diosmeae*: (1) *flowers* solitary with several bract-like basal leaves, terminal or axillary; (2) *petals* connate with the staminode below; (3) *anther* with a minute apical gland; (4) *disc* obvallate; (5) *stigma* capitate; (6) *style* and *filaments* short, glabrous, erect; (7) *ovary* 5-carpellate.

Coleonema aspalathoides is a distinct species with leaves that have a dark green colour, somewhat reflexed above with a long sharp point, with petals having a short broad claw that is pubescent and ciliate below, a blade relatively narrow so that they do not overlap each other at the margins. It is nearest in appearance to *Coleonema pulchellum* Williams which however has the bracts, bracteoles and sepals always glabrous on the outside. The differences in the flowers are as shown below:

C. aspalathoides [illegible]	*C. pulchellum*
flowers 8–10 mm diam. [illegible]	flowers 7 mm diam.
petals obovate with a longer apiculus;	petals orbicular with a minute apiculus;
with spaces between;	more nearly touching;
edges somewhat incurled;	edged fairly flat;
gradually recurved at throat;	abruptly recurved at throat;
sparsely gland-dotted;	without any gland dots;
surface irregular with large watery cells;	surface smooth;
staminodes deeper in throat.	staminodes protrude.

ACKNOWLEDGEMENT

I wish to acknowledge with deep gratitude the assistance received from Dr. Heino Heine of the Muséum National D'Histoire Naturelle in Paris in examining closely the specimen of *C. aspalathoides* in the Jussieu Herbarium and for his comments on this matter.

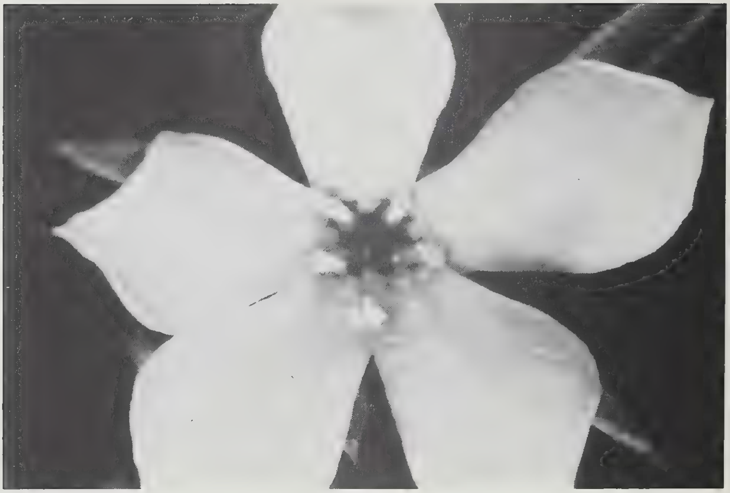

Fig. 10.
Coleonema aspalathoides: flower, 8 mm diam.

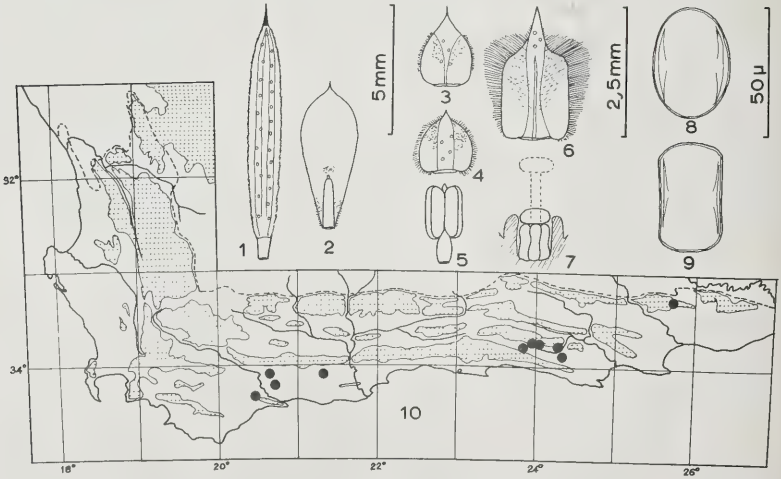

Fig. 11.
Coleonema aspalathoides: 1, leaf. 2, petal with staminode. 3, uppermost bract. 4, bracteole. 5, anther. 6, calyx lobe. 7, gynoecium and disc. 8 and 9, pollen. 10, distribution.

6. **Coleonema pulchellum** Williams, sp. nov. affinis *C. aspalathoides* Juss. ex Don sed bractis, bracteolis sepalis et petalis extus glabris, petalis anguste unguiculatis, sepalis non villosociliatis, stylo crassiore differt.

Frutex 800 mm, densus, erectus, ad basin monocaulis. *Rami* erecti, graciles, numerosi. *Ramuli* erecti, graciliores, numerosi, minute puberuli, foliosi. *Folia* 8–10 mm longa, 0,8 mm lata, lineari-lanceolata, pungentia, petiolata, bifariam glanduloso-punctata, glabra erecta, alterna, marginibus anguste hyalinis denticulato-serrulatis. *Inflorescentia* solitaria, terminalis vel axillaris; *flos* 7–8 mm diam., roseus. *Bractea* intima 2 mm longa, 1,2 mm lata, deltoidea, pungentia, glabra, costa virida glanduloso-punctata, marginibus late hyalinis, ciliatis. *Bracteolae* duae, 2 mm longae, 1,3 mm latae, deltoideae, pungentiae, extus glabrae, intus pubescentiae, costa virida glanduloso-punctata, marginibus late hyalinis, ciliatis. *Sepala* quinque, 2 mm longa, 1,3–1,4 mm lata, late oblonga, apiculata, intus pubescentia, extus glabra, costa virida glanduloso-punctata, marginibus late hyalinis crispo-ciliatis. *Petala* quinque, 5–5,7 mm longa, 2,3–2,8 mm lata, glabra, roseus; *limbus* orbicularis, apiculatus, patens, marginibus indistincte hyalinis; *unguis* 2,2 mm longus, 1 mm latus, ad basin staminodio connatum. *Staminodia* quinque, 2,2 mm longa, 0,5 mm lata, glandula coronata, partim petalis connata. *Fila* quinque, 2 mm longa, glabra. *Antherae* quinque, ante anthesin 1,1 mm longae, 0,7 mm latae, flavidae, glandula coronata. *Pollen* 45 μ longum, 22 μ latum, oblongum. *Discus* viridus, succulentus, obvallatus, ovarium aequans. *Stigma* 0,5 mm diam., globosum, capitatum. *Stylus* 1,1 mm longus, erectus, glaber, persistens. *Ovarium* 5-carpellatum, 0,9 mm longum, 0,8 mm diam., glabrum. *Fructus* 5-carpellatus, 5,1 mm longus, 4,5 mm diam., glaber, marginibus multi-glanduloso-punctata; *cornua* 1,2 mm longa, erecta, emarginata, extus immerso-apici-glandulata. *Semen* 2,8–2,9 mm longum, 1,5 mm latum, piceum, nitens.

Type: CAPE—3325 (Port Elizabeth): Winterstrand, Port Elizabeth, flat ground behind the coastal dune (-DC), sea level, 26/8/1975, *Williams 2056* (NBG, holotype; BOL, K, L, MO, NSW, PRE, S, STE, isotypes).

Shrubs 800 mm tall, dense, erect, single-stemmed at base. *Branches* numerous, erect, slender; bark brownish; cuticle splitting. *Branchlets* very numerous, erect, slender, leafy, densely and minutely puberulous. *Leaves* 8–10 mm long including petiole 1 mm long, 0,8 mm broad, linear-lanceolate, acute, pungent, alternate, erect; hyaline margins narrow, denticulate-serrulate with teeth pointing upwards; adaxial surface glabrous except at the petiole, flat when fresh; round-backed, glabrous with one row of gland dots to either side of the midrib. *Inflorescence* solitary, terminal on short branchlets or axillary on very much reduced branchlets often crowded towards the tops of the branches; flowers 7–8 mm diam., pink to almost white in colour. *Bract* the uppermost four leaves by degrees alter into bracts, the last below the two bracteoles being 2 mm long, 1,2 mm broad, deltoid, glabrous; midrib green, gland-dotted, produced into a pun-

gent apex with 2 hairs at the tip; margins ciliate, broadly translucent. *Bracteoles* two, 2 mm long, 1,3 mm broad, deltoid, pubescent inside above otherwise glabrous; midrib gren, gland-dotted, produced into a pungent apex with or without a single hair at the tip; margins ciliate, broadly translucent. *Calyx lobes* five, 2 mm long, 1,3–1,4 mm broad, broadly oblong, pubescent adaxially otherwise glabrous; midrib green, gland-dotted, apiculate; margins crisped ciliate, broadly translucent. *Petals* five, 5–5,7 mm long, glabrous; *limb* 2,3–2,8 mm broad, orbicular, apiculate, pink, spreading; *claw* 2,2 mm long, 1 mm broad above, 0,5 mm at base; midrib connate with the staminode but grooved and free above. *Staminodes* five, 2,2 mm long, 0,5 mm broad, narrowing to a small glandular apex, connate with the petal except right at the tip, equalling the claws and the spent anthers. *Filaments* five, 2 mm long, glabrous, erect, acicular. *Anthers* five, before anthesis 1,1 mm long, 0,7 mm broad, yellow, with a minute sessile, globose apical gland. *Pollen* 45 μ long, 22 μ broad, oblong. *Disc* slightly wavy, erect, equalling the ovary, dark green, fleshy with petals staminodes and anthers arising at the base. *Stigma* 0,5 mm diam. globose, capitate. *Style* becoming 1,1 mm long, erect, glabrous, persisting. *Ovary* 5-carpellate, 0,9 mm long, 0,8 mm diam., glabrous; carpels with globose apices. *Fruit* 5-carpellate, 5,1 mm long, 4,5 mm diam., glabrous; carpels dimpled and laterally ridged with many gland dots; *horns* 1,2 mm long, erect, emarginate; apical gland immersed facing outwards. *Seed* 2,8–2,9 mm long, 1,5 mm broad, black, shining.

The "Confetti Bush" has long been cultivated in gardens where it has been known by the name *Coleonema pulchrum*. Ecklon and Zeyher (1835) were the first to list their collections of this plant from the Eastern Cape under this name. In *Flora Capensis*, Sonder (1859/1860) included plants from both the Swellendam District and from the Eastern Cape near Port Elizabeth under *C. pulchrum* Hook. His synonomy includes no less than four distinct taxa. The specimen from which Hooker prepared his drawing and description of *Coleonema pulchrum* in *Curtis's Botanical Magazine* (1834) is preserved in the herbarium at Kew and this plant with its leaves 35 mm long and 15 mm diam. is very plainly different from *Coleonema pulchellum* here described with leaves 10 mm long and flowers 0,8 mm diam. Hooker's specimen was cultivated in the Botanical Garden at Glasgow and similar plants have been found in the wild in the vicinity of Swellendam from whence the seed must have been originally obtained.

The first person actually to collect specimens of *C. pulchellum* was Burchell who found it in December 1813 at Algoa Bay. It seems regrettable that he made so little use of his collections which were unique and far better recorded than any before his time.

SPECIMENS EXAMINED

CAPE—3423 (Knysna): Robberg near Plettenberg Bay, Knysna Division (-AB), 500 ft. alt., 4/5/1952, *Taylor 380* (NBG); cliffs on S.E. side, 25/10/1955,

Esterhuysen 25010 (BOL); Witsand, 350 ft., 25/8/1975, *Williams 2051* (NBG).
—3424 (Humansdorp): Klipdrift, Humansdorp Division (-BA), May/June 1930, *Thode A2468* (K, PH, PRE).
—3325 (Port Elizabeth): at the upper part of the Lead Mine River (-CD), 7/2/1814, *Burchell 4616* (K); flats between Krakakamma and Vanstaadensberg, 500–1 000 ft., –/7/–, *Zeyher 5.7* (BOL, C, E, G, GRA, PRE); between Vanstaadensberg and Bethelsdorp, under 1 000 ft., IV C.c.15, –/12/–, *Drège 7143* (G, K, P); in collibus prope Bethelsdorp et in planite magna sub montes Vanstaadensberge altit. II (Uitenhage), –/7/–, *Ecklon & Zeyher 836* (C, G, K, PRE); Cape Road 12th mile, Port Elizabeth, 7/8/1932, *Long 692* (GRA, K, PRE); west of Port Elizabeth towards Witteklip, 26/8/1947, *Rodin 1020* (BOL, K, PRE); at Algoa Bay near the Burying Ground (-DC), 11/12/1813, *Burchell 4316* (K); at Algoa Bay near the Block House, 13/12/1813, *Burchell 4346* (K); in a walk by the Baakens River under Fort Frederick, 14/12/1813, *Burchell 4352* (K); Uitenhage, on the downs along the strand of Algoa Bay, by Port Elizabeth and Cape Recife, –/12/–, *Zeyher 747* (BM, K, NGB, PRE); in moist places Walmer Flats near Port Elizabeth, 300 ft. alt., –/9/1868, *H. Bolus 1901* (BOL); Port Elizabeth, Birchells Valley, 27/7/1895, *H. Bolus s.n.* (NBG, *Guthrie 3762*); beach, Port Elizabeth, –/1/1907, *Potts 306* (BOL, GRA, PRE); Humewood near Port Elizabeth, –/8/1912, *Paterson 780* (BOL, GRA), –/9/1921, *Cruden 323* (PRE), 6/7/1947, *Urton 23* (GRA), *Urton 57* (GRA), 26/4/1962, *Dahlstrand 92* (C), –/9/1911, *Daly 1068* (GRA), –/8/1906, *West 48* (GRA, K), 4/8/1931, *Long 433* (K, PRE), –/6/1900, *Sim 41* (PRE), –/10/1900, *Sim B14* (PRE), –/11/1900, *Sim s.n.* (PRE), –/9/1960, *Haasbroek 1876* (PRE), 6/8/1944, *Long 1482* (PRE), *1483* (PRE), 26/2/1961, *Dahlstrand 14* (PRE); Winterstrand at sea level, 26/8/1975, *Williams 2056* (NBG, BOL, K, L, MO, NSW, PRE, S, STE).
—3425 (Skoenmakerskop): within 2 miles of Skoenmakerskop, Port Elizabeth (-BA), –/10/1921, *Forest Department Port Elizabeth 29* (GRA); Skoenmakerskop, Port Elizabeth, sea shore, 20 ft. alt., 5/7/1925, *Borle 1* (K, PRE).
—3326 (Grahamstown): Alexandra Division, Bushmans River Mouth, along banks of the spring Klipfontein (-DA), 200 ft. alt., 28/8/1952, *Archibald 4542* (PRE).

Distribution and Biology

Coleonema pulchellum is found mainly in the Port Elizabeth area along the coast towards Cape Recife and on the plains around Greenbushes with outliers on Robberg at Plettenberg Bay 180 km to the west, and at the Bushmans River Mouth 100 km to the east. It occurs at altitudes from sea level near Port Elizabeth up to 150 m (500 ft.) on Robberg, growing in windblown sandy soil with deposits of coastal limestone not far away. The flowering season appears to be from March to October and fruits have been found from August to January. The presence of conspicuous spreading petals and a fleshy disc in the flower with the style lengthening only after anthesis would indicate that this plant is most probably pollinated by insects. Seed when ripe is scattered by the usual catapult mechanism. The leaves have a pleasant sweet smell when crushed.

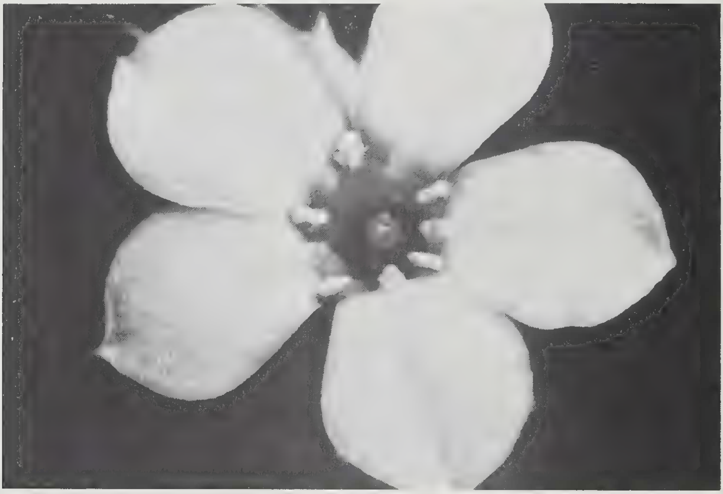

FIG. 12.
Coleonema pulchellum: flower, 7–8 mm diam.

DISCUSSION

Having the staminode connate with the petal, looking very much as though it lies within a groove in the petal, places this species in the genus *Coleonema*. Other characters that exclude this plant from other genera of the *Diosmeae* are: (1) *flowers* solitary, terminal or axiliary on reduced branchlets; (2) *petals* clawed, spreading; (3) *anther* with a minute apical gland; (4) *disc* obvallate; (5) *stigma* 0,6 mm diam., capitate; (6) *style* and *filaments* short, glabrous, erect; (7) *ovary* 5-carpellate.

Coleonema pulchellum is a distinct species resembling *C. aspalathoides* Juss. ex Don but differing in having bracts, bracteoles, sepals and petals always glabrous on the outside, petals with narrow claws, sepals not villous-ciliate and the style somewhat thicker. It differs from *C. pulchrum* Hook. and *C. virgatum* E. & Z. from the Langeberg near Swellendam, which have much longer leaves and larger flowers. All other species of *Coleonema* have very small white flowers.

7. **Coleonema virgatum** (Schldl.) Ecklon & Zeyher, Enum. Plant.: 106 (1835). *Coleonema album* (Thunb.) Bartl. & Wendl. var *B. virgatum* Schldl. in *Linnaea*

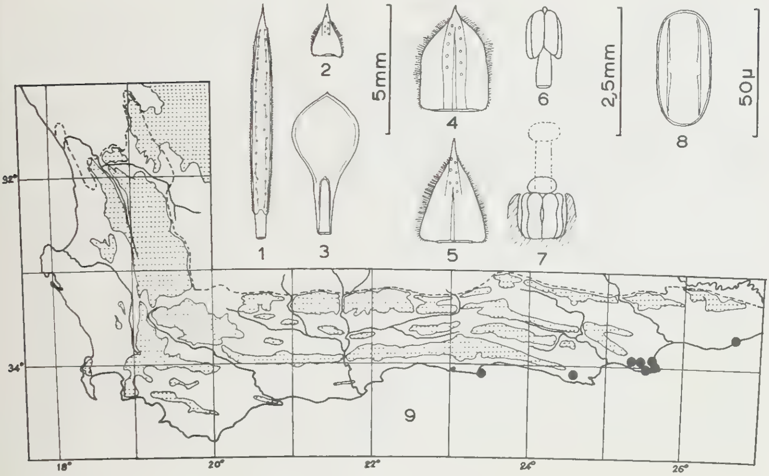

FIG. 13.
Coleonema pulchellum: 1, leaf. 2, uppermost bract. 3, petal with staminode. 4, calyx lobe. 5, bracteole. 6, anther. 7, gynoecium and disc. 8, pollen. 9, distribution.

6: 199 (1831). Type: Duivelsbosch bei Swellendam, 16/10/1826 (or 1828) *Ecklon s.n.* (SAM, lectotype; S, isotype).

Shrubs probably up to 1 m tall, arising from a single stem at base. *Branches* fairly straight, glabrous, dark brown, smooth with transverse leaf scars becoming double-lipped when old. *Branchlets* fairly numerous, slender, straight, erect, glabrous, tinged with red. *Leaves* 26–32 mm long including petiole about 1,5 mm long, 1,2–1,3 mm broad, linear, acute-subulate, glabrous, spreading-erect, alternate; margins narrowly translucent, minutely serrulate with erect sharp points; adaxial surface flat; abaxial surface rounded, multi-gland-dotted to either side of the midrib. *Inflorescence* solitary, terminal or axillary, sessile, pale pink or white. *Bract* 4,5 mm long, 0,9 mm broad, linear-lanceolate, subulate; margins ciliolate, broadly translucent below, rolled in above; adaxially very sparsely pubescent along the midrib; abaxially glabrous, gland-dotted, midrib prominent below. *Bracteoles* two, 3,3–3,4 mm long, 1,1 mm broad, lanceolate, subulate; margins ciliolate, broadly translucent below, rolled in above; adaxially sparsely pubescent along the midrib; abaxially glabrous, gland-dotted above. *Calyx lobes* five, 3,5 mm long, 1,4 mm broad, oblong, subulate above with a long sharp point; margins ciliolate, broadly translucent below, rolled in above; adaxially sparsely pubescent towards the midrib; abaxially glabrous, gland-dotted above.

Petals five, 6,3–6,5 mm long overall, 2,7–3 mm broad, elliptic, apiculate, glabrous, eglandular, without any translucent margins; *claw* 2,7 mm long, connate with the staminode with an elevated groove running 0,6 mm up above the apex of the staminode. *Staminodes* five, 2,3 mm long, connate with the claw of the petal except at the apex which is tipped with a small gland. *Filaments* five, becoming 2 mm long, erect, glabrous. *Anthers* five, 0,6 mm long, 0,5 mm broad, yellow; apical gland small, somewhat pointed. *Pollen* 30 μ long, 21 μ broad, ellipsoid. *Disc* obvallate, exceeds the ovary, equals the top of the stigma at first, fairly narrow and level on top. *Stigma* 0,5 mm diam., depressed globose, sessile at first. *Style* erect, glabrous, becoming 1 mm long, persisting. *Ovary* 5-carpellate, 0,8 mm long, 0,8 mm diam., glabrous; apices globose with an immersed gland. *Fruit* 5–5,5 mm long, 4,5 mm diam., glabrous, gland-dotted; horns 1 mm long, incurved-erect, with an immersed gland facing outwards at the tip. *Seed* 3,3 mm long, 1,5 mm broad, black, shining.

Coleonema virgatum was collected by Ecklon on the 16th October (1826 or 1828) on the mountain slopes above Duivelsbos at Swellendam. Duivelsbos is an indigenous forest to the north of Swellendam on the south slopes of the Langeberg. Sheets so labelled are to be found at SAM and S. What appears to have been a separate collection of the same species possibly made by Zeyher from above Puspasvalley is labelled *Coleonema virgatum E.Z. 70.10.* Sheets so labelled are to be found at C, E and S. Specimens possibly distributed by both Ecklon and Zeyher bearing their usual printed label extracted from their *Enumeratio* (1835) giving both the above localities and numbered *832* are to be found at C, E, S and SAM.

Von Schlechtendal's herbarium is reputed to be at Halle in East Germany but inquiries there have failed to establish this; nor is there any material still extant at Berlin. For this reason and until the specimen actually seen by von Schlechtendal is found, a specimen in the collection of the South African Museum Herbarium at Kirstenbosch has been chosen as the lectotype. The validity of other specimens at C, E, S and SAM remains doubtful. The relevant sheet in the herbarium of the South African Museum bears two specimens. On the right hand side is a twig of *C. virgatum* about 430 mm long, without flowers or fruits, with Ecklon and Zeyher's usual printed label. On the left hand side is a twig, which has been chosen as the lectotype, about 280 mm long bearing both flowers and fruits and with a label bearing the inscription *Duivelsbosch bei Zwellendam, Oct. 16* in Ecklon's hand. This is the locality mentioned by von Schlechtendal when he described *C. album* var. *virgatum* in *Linnaea* (1831).

Puspasvalley, which is not marked on modern maps, is more or less the area known as the Hermitage. It was above this farm that the Rev. T. M. Wurts made two collections of *C. virgatum* in 1952 on the south ridge of One O'clock Peak. As far as is known no other collections have ever been made in this vicinity.

SPECIMENS EXAMINED

CAPE—3320 (Montagu): Duivelsbosch bei Swellendam (-CD), 16/10/1826 (or 1828), *Ecklon s.n.* (S, SAM); Coleonema virgatum E.Z., 70.10, *Zeyher ? s.n.* (C, E, S); In lateribus montium prope Swellendam supra Duivelsbosch er Puspasvalley, Altit. IV, Oct., *Ecklon & Zeyher 832* (C, E, S, SAM); One O'clock Mountain, south ridge, Swellendam, 3 000–4 000 ft., 30/6/1932, *Wurts 204* (NBG), 16/8/1952, *Wurts 204a* (NBG). not NU. Riversdal
—3321 (Ladismith): Garcias Pass, mountain slopes, Riversdale Division, (-CC), –/9/1908, *Phillips 347* (SAM); Garcias Pass, wooded valley opposite Toll House, Riversdale Division, 1 200 ft., –/9/1897, *Galpin 3856* (GRA).

DISTRIBUTION

Very few collections of this plant have been made. Its occurrence in the mountains above Swellendam to the west and above Riversdale to the east is rather odd because in between above Heidelberg one finds a very closely related species *C. pulchrum* Hook. If and when more material becomes available it may be possible to reassess the status of *C. virgatum.*

DISCUSSION

Having the staminode connate with the petal places this plant within the genus *Coleonema*. Other characters which exclude this plant from other genera of the *Diosmeae* are: (1) *flowers* solitary, terminal or axillary; (2) *petals* glabrous, clawed, spreading; (3) *anther* with a minute apical gland; (4) *disc* obvallate; (5) *stigma* 0,5 mm diam., capitate; (6) *style* and *filaments* short, glabrous, erect; (7) *ovary* 5-carpellate.

Coleonema virgatum is a distinct species with pale pink or white flowers resembling *C. pulchrum* Hook. but differing in having somewhat longer leaves, with bracts, bracteoles and calyx lobes subulate towards the apex and with smaller flowers with petals without any gland dots. It differs from both *C. aspalathoides* and *C. pulchellum* which have shorter leaves. All other species of *Coleonema* have white flowers.

8. **Coleonema pulchrum** Hook. in Curtis's Bot. Mag. **61**: 3340 (1834). Type: *Hort. Glasglow s.n.* (K, lectotype). Matches plate 3340 in Curtis's Bot. Mag.

Diosma angustifolia Hort. *Curtis's Bot. Mag.* **61**: 3340 (1834), nom. nud.

Shrubs to 1,2 m tall, erect, virgate, arising from a single stem at base. *Branches* erect, slender; bark splitting becoming light brown, smooth with small rather distant leaf scars. *Branchlets* erect, slender, minutely puberulous, hidden by the leaves. *Leaves* to 35 mm long on vigorous young stems, more usually 15–18 mm long including petiole about 1 mm long, 1–1,2 mm broad, linear, acute, mucronate, glabrous, pale green, straight, erect, loosely imbricate, alternate; margins minutely ciliolate becoming smooth; adaxially concave; abaxially

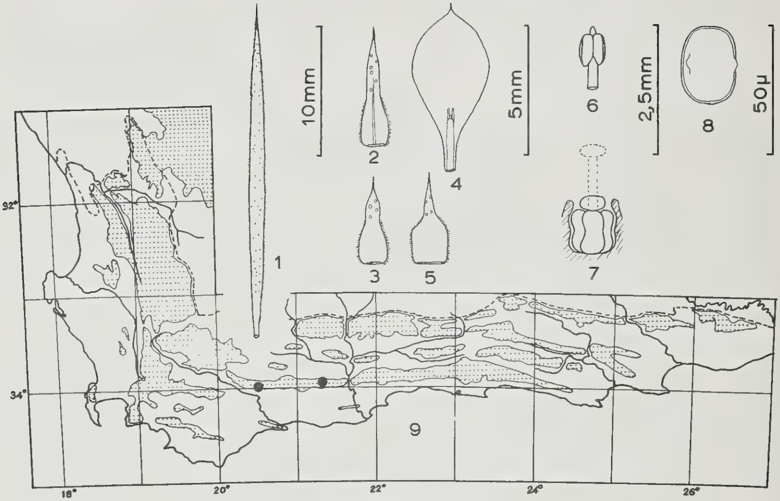

FIG. 14.
Coleonema virgatum: 1, leaf. 2, uppermost bract. 3, bracteole. 4, petal with staminode. 5, calyx lobe. 6, anther. 7, gynoecium and disc. 8, pollen. 9, distribution.

convex, gland dots scattered ± in two rows to either side of the midrib.*Inflorescence* solitary, terminal or axillary in the uppermost leaves, 12–13 mm diam., pink. *Bracts* five, increasing evenly in size from 1,4 mm long, 0,4 mm broad at the base to 3,6 mm long, 1 mm broad below the bracteoles, oblong to lanceolate, acute with a small sharp mucro; margins ciliolate, narrowly translucent; adaxially very sparsely pubescent; abaxially glabrous, gland-dotted to either side of the midrib. *Bracteoles* two, 3,4 mm long, 1,2 mm broad, lanceolate, acute, apiculate, ciliolate with broad translucent margins, glabrous, gland-dotted and reddened along the midrib; adaxially pubescent. *Calyx lobes* five, 3 mm long, 1,5 mm broad, broadly lanceolate, acute, apiculate; margins broadly translucent, ciliolate; adaxially pubescent; abaxial surface glabrous, gland-dotted and reddened along the midrib. *Petals* five, 7,6–8,5 mm long overall; limb 5,3 mm long, 3,6–4,2 mm broad, obovate, apiculate, glabrous, gland-dotted on the underside, pink, spreading; *claw* 2,5 mm long, narrowing to 0,4 mm wide at the base, glabrous, connate with the staminode except above where two small pointed processes surround the apical gland of the staminode on either side. *Staminodes* five, 2,5 mm long, 0,3 mm broad, connate with the petal except above; apical gland conical, exudes nectar. *Filaments* five, becoming 1,7 mm long, acicular, glabrous, erect. *Anthers* five 1,1 mm long, 0,6 mm broad, yellow; apical gland small, globose, exudes nectar. *Pollen* 47 μ long, 27 μ broad, ellipsoid. *Disc* obvallate, margin free, exceeds the ovary, equalling the stigma, fairly narrow, level above, green, exudes nectar. *Stigma* 0,4 mm diam., capitate, depressed globose. *Style* becoming 1,3 mm long, slender, glabrous, erect, persisting. *Ovary* 5-carpellate, 0,8 mm long, 0,8 mm diam., glabrous, apices globose. *Fruit* 5-carpellate, 5,5 mm long (6,7 mm long to the tips of the horns), 4,7 mm diam., 6,7 mm broad across the horns, green, glabrous, many gland-dotted; *horns* 2 mm long, spreading and curved up slightly; apices emarginate clasping an immersed gland. *Seed* 4,6 mm long, 1,8 mm broad, black, shining; aril black capped.

W. J. Hooker in describing this plant in *Curtis's Botanical Magazine* stated that it had "long been cultivated in the greenhouse of the Botanic Garden of Glasgow under the name of *Diosma angustifolia*". A specimen preserved in the herbarium at Kew, annotated "Hort. G. L. (Glasgow)" is apparently the flowering twig from which Hooker prepared his excellent drawing in 1834. It has been chosen as the lectotype.

SPECIMENS EXAMINED

CAPE—3320 (Montagu): Tradouw Pass near the cave, Heidelberg Division (-DC), 1 000 ft., 2/11/1975, *Williams 2131* (NBG); Tradouw Pass, south side, amongst rocks, 4/9/1955, *Esterhuysen 24612* (BOL, PRE), 9/9/1924, *Compton 3447* (BOL), 3 000 ft., –/9/1917, *Marloth 7757* (PRE), –/10/1917, *Marloth 8621* (PRE), 29/9/1947, *Walgate 915* (PRE), 1 000 ft., 24/9/1949, *Acocks 15449* (PRE, K), 24/9/1949, *Sidey 1794* (PRE, S), 6/8/1950, *Martin 401* (NBG), 6/8/1950, *Barker 7377* (NBG); Tradouw Pass, kloof beyond highest point, w. facing amongst rocks, 390 m, 4/12/1978, *Williams 2654* (NBG); Tradouw Peak and ridge above Pass, 2 500–4 400 ft., 5/9/1977, *Esterhuysen 34618* (BOL); Zuurbraak Mountain, wooded gorge, 1 000 ft., –/10/1897, *Galpin 3855* (GRA, PRE); Zuurbraak Peak, Swellendam, –/10/1925, *Barnard s.n.* (SAM).

Without precise locality: Diosma conspicua, Prom. B. Spei. –/–/1771, *Banks & Solander s.n.* (BM), *Verreaux s.n.* (G.)

Cultivated specimens: *Hort. Glasgow* (K), Bot. Gard. Edinburgh, 3/5/1841, *Graham s.n.* (G), –/4/1845, *Mus. de Hist. Nat. de Paris* (G), –/–/1850, *Hort. Kew* (S), –/–/1853, *Hort. Schonbrunn* (S).

DISTRIBUTION AND BIOLOGY

The distribution of *Coleonema pulchrum* appears to be extremely limited. It has only been found in the vicinity of the Tradouw Pass extending perhaps five kilometres to either side on the southern slopes of the Langeberg. It grows in rocky places at altitudes from 305 to 1 340 metres. In 1897 Galpin observed plants that were 8 feet tall. In 1949 Acocks noted that the plants were 4 ft. tall and locally fairly frequent. Road widening is now in progress in the pass and one population near to the roadside had been eliminated. Miss Esterhuysen reports (verbal communication) that this species is still fairly plentiful higher up in the mountains between Tradouw Pass and Grootvadersbos. Flowering takes place from August to November. The large pink flowers and the presence of nectar indicate pollination by insects. Seed when ripe is ejected by the usual catapult mechanism and regeneration takes place from seed normally only after fires. The leaves have a sweet turpentine smell when crushed.

DISCUSSION

Having the staminode connate with the petal places this plant in the genus *Coleonema*. The following characters also contribute to exclude it from other genera of the Diosmeae: (1) *flowers* solitary, terminal or axillary, each with several basal bracts; (2) *petals* with an elevated groove enclosing the apex of the staminode, connate with the staminode below; (3) *anther* with a minute apical gland; (4) *disc* obvallate, narrow, exceeds the ovary; (5) *stigma* capitate; (6) *style* and *filaments* short, glabrous, erect; (7) *ovary* 5-carpellate.

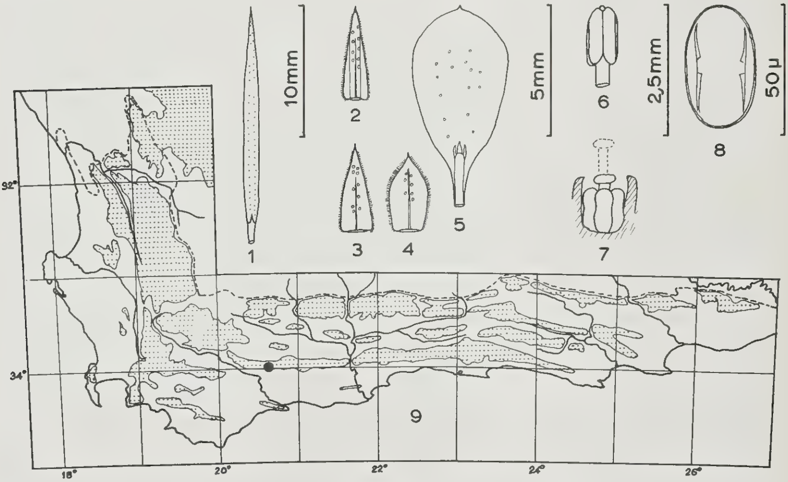

FIG. 15.
Coleonema pulchrum: 1, leaf. 2, uppermost bract. 3, bracteole. 4, calyx lobe. 5, petal with staminode. 6, anther. 7, gynoecium and disc. 8, pollen. 9, distribution.

Coleonema pulchrum is a distinct species having linear leaves, up to 35 mm long and large pink flowers up to 13 mm diameter with many gland dots on the underside of the petals. It differs from *C. virgatum* which has smaller flowers without gland dots on the petals and leaves, also bracts and calyx lobes with more subulate apices. It differs from *C. pulchellum* and *C. aspalathoides* which have shorter leaves and smaller flowers. All other species of Coleonema have white flowers.

IMPERFECTLY KNOWN SPECIES

Coleonema filiforme A.Juss. ex Don., Gard. and Bot. **1**: 783 (1831) nom. nud. Type: *Diosma filiformis* D.C. herb. ex A.Juss. (P) = *C. pulchellum* Williams ?
Coleonema barosmoides Schltr. in Engl. Bot. Jb. **27**: (1899) nom. nud. Type: unknown. = *C. aspalathoides* Juss. ex Don.?

SPECIES EXCLUDED

Diosma rubra L. Sp. Pl. **1**: (1753). *Diosma foliis linearibus acutis glabris subtus bifariam punctatis*. Type: (LINN *240/4* as to right hand specimen only, lectotype).

In a paper published by the author in 1974 the name *Diosma rubra* was rejected. However the recent publication of the revised *International Code of Botanical Nomenclature* adopted by the twelfth congress in 1975 has made it necessary to lectotypify this name. On the type sheet of *Diosma rubra* L. in London there are two specimens. On the left hand side is what is currently known as *Coleonema album* (Thunb.) Bartl. & Wendl. and on the right hand side is what is currently known as *Diosma hirsuta* L. It is clear therefore that Linnaeus' concept of his *Diosma rubra* was based on these two elements of which it is now necessary to choose one as a lectotype. As current usage in the past has tended to regard *Diosma rubra* L. as being a variety of *Diosma hirsuta* L., I therefore propose to choose the right-hand specimen on sheet *240/4* in the Linnaean herbarium as the lectotype of the name *Diosma rubra* L. This is a mature twig of a species already described as *Diosma hirsuta* L., bearing the characteristic fruits with petals persisting. The name *Diosma rubra* L. and the combination *Coleonema rubrum* (L.) Druce are consequently reduced to synonomy under *Diosma hirsuta* L.

Diosma ericoides L. Sp. Pl. **1**: 198 (1753). *DIOSMA foliis lineari-lanceolatis subtus convexis bifariam imbricatis*. Type: Pluk. Phytogr. t.279, f.5 (1696), iconolectotype.

Under *Diosma* in the *Hortus Cliffortianus* (1737), Linnaeus described three species of which only the first was actually in cultivation in Clifford's garden. The second and third were based upon polynomials and figures in existing literature. In the *Species Plantarum* ed. 1 (1753) he divided the third species, *Diosma foliis setaceis acutis*, described in the *Hortus Cliffortianus*, into two parts, citing the first polynomial, i.e. *Diosma foliis setaceis acutis*, under his new *Diosma rubra* and the other polynomial, a direct quote from Plukenet, under the new *Diosma ericoides*.

A study of the material in Linnaeus' herbarium reveals that, at the time he published the *Species Plantarum* ed. 1 (1753), he had no dried plant material relating to *D. ericoides* in his possession (*fide* Dr T. T. Barnard, written communication). Under *D. ericoides* Linnaeus cited firstly "*Spiraea africana, ericae bacciferae foliis.* Raj. dendr.: 91" and secondly *"Ericaeformis, coridis folio, aethiopica, floribus pentapetalis in apicibus."* Pluk. Amalth.: 236, t.279, f.5."

With regard to the first polynomial, *Spiraea africana, ericae bacciferae foliis*, it is impossible to relate Ray's polynomial to any known plant and no specimen survives. However a very good description in Phillip Miller's *Figures of Plants* (1760) leaves no doubt in one's mind that he thought that it referred to *Coleonema album*. He even makes Linnaeus' description of *Diosma ericoides* appear to fit this plant.

The second polynomial, *"Ericaeformis . . . etc.*, refers to a figure in Plukenet's *Phytographia* t.279, f.5. The original specimen from which this drawing was made is preserved in the Sloane herbarium at the British Museum of Natural History and there can be no doubt that this plant is not *Coleonema album* but is a species of *Diosma*.

The diagnosis given by Linnaeus for his *D. ericoides* in the *Species Plantarum* (1753), *"DIOSMA foliis lineari-lanceolatis subtus convexis bifariam imbricatis"*, cannot with certainty be attached to either of the above-mentioned plants, both of which have linear-lanceolate leaves. The words *"subtus convexis"* were plainly inserted to distinguish his description from any of the Ericaceae which often have leaves furrowed below and furthermore, neither plant, seeing that they possess alternate leaves, may be said to have leaves "imbricated in two rows".

Under the latest rules of nomenclature a type must be selected. As it is not known whether or not Linnaeus ever saw Plukenet's Herbarium, where the actual specimen upon which the figure cited by Linnaeus is preserved, the drawing fig. 5. on page 279 in Plukenet's *Phytographia* is chosen as the iconolectoeltype. The engraver has certainly made the plant look rather as if its leaves are imbricated in two rows as stated by Linnaeus in his diagnosis.

PHYTOGEOGRAPHY

An examination of the distribution maps relating to the various species in the genus *Coleonema* leaves one with the impression that we have a jigsaw puzzle in which some of the pieces are missing. Gaps and disjunctions are a feature of this genus. There are many mountains where no species of *Coleonema* have as yet been collected. The list is formidable: Piketberg, Riebeekskasteel, Paardeberg, Paarlberg, Southern Cedarberg, Cold Bokkeveld, Swartruggens, Swartberg, Hex River Mountains, Anysberg, Touwsberg, Roodeberg, Kamanassie Mtns., Baviaanskloof Mtns., Cockscomb Mtns., Outeniquas, Tzitzikama Mtns., etc. There are also vast areas of sandy flats and coastal limestone where other genera of the *Diosmeae* are found but as yet no species of *Coleonema*. None occur above an altitude of 1 400 m and, like other members of the *Diosmeae*, none are found growing on soils derived from the Malmesbury shales or from the Bokkeveld Series. In some species populations are found to be growing in isolated or severely restricted habitats such as: south slopes beneath small cliffs; amongst rocks on the T.M.S. outcrops; associated with silcrete-capped hills, etc.

Five species of *Coleonema* show distribution patterns with large disjunctions. In the case of the two more or less coastal species *C. album* and *C. pulchellum*, distribution might have taken place in former times during the various ice ages when the sea was at times at a much lower level and a suitable habitat lay exposed. The subsequent rise in sea level leaving the the outliers still surviving. Two other species *C. calycinum* and *C. aspalathoides*, which now occupy isolated and often restricted habitats, might have been widely spread when geological conditions were very different with vast areas between the mountain ranges still covered with silcrete peneplains derived from the erosion of the quartzitic mountain ranges. Subsequent erosion, perhaps due to the changes in the main river systems from east-west to north-south, isolated the populations from each other. If this is so it indicates the great age and endurance of these species. The main populations of *C. juniperinum* in the South West Cape consist of small, often diffuse, bushes rather soft to the touch. To the north, after a gap of 130 km, the plants are found to be quite large, stiff and almost prickly in a very much drier climate. No doubt high rainfall requirements have kept *C. nubigenum* confined to a fairly small area in the mountains of the South West Cape where it is none the less plentiful. The lack of success of *C. virgatum* and *C. pulchrum* in spreading much more widely along the Langeberg may seem strange until one considers the many other species that have relatively restricted distributions along the same range of mountains where, with the abundant rainfall, the competition must be very great.

Certainly the fact that *Coleonema* is absent from many areas is due largely to the small number of species in the genus. Here we are dealing with only eight out of a total of about 258 species in the *Diosmeae* a mere 3,1 %. Another reason may be that, in general, the plants require areas with a fairly high rainfall, peculiar habitats including possibly restricted altitude tolerances.

While agreeing that the small, slippery seeds after being ejected, may be transported short distances by ants, which may be able to grip and feed upon the aril, one simply cannot postulate any form of distribution over vast distances by any agency such as the wind or by birds. One is therefore forced to the conclusion that these species have been in existence for a very long time indeed.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance and facilities made available to him at both the Bolus Herbarium with its invaluable library, at the University of Cape Town and the Compton Herbarium at Kirstenbosch. Loans of specimens have been made from and/or visits made to the following herbaria: B, BM, BOL, C, E, G, GRA, K, LINN, NBG, P, PH, PRE, S, SAM, UPS (abbreviated according to Lanjouw & Stafleu, 1964). The assistance received from these institutions is acknowledged with thanks. Special help in the elucidation of various problems has been received from Dr T. T. Barnard, Dr Peter Goldblatt, Dr Heino Heine and Dr J. P. Rourke and this is sincerely appreciated.